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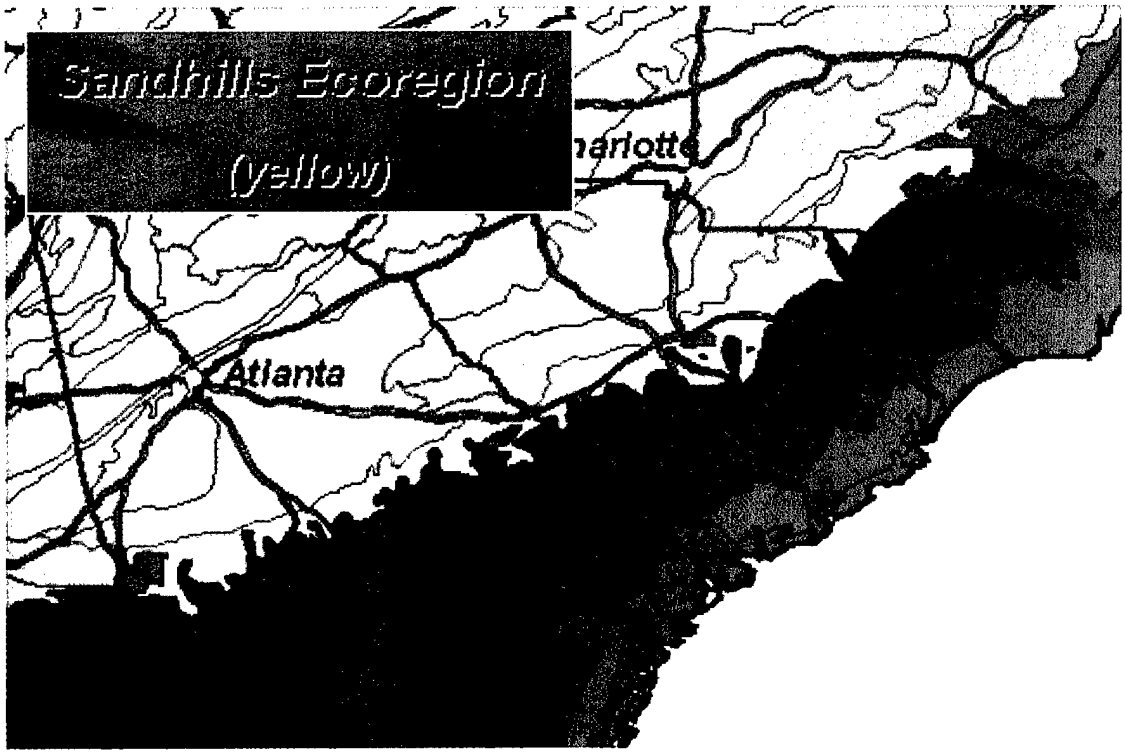
Robert C. Lozar, Harold E. Balbach, William D. Goran and Beverly Collins

March 2002



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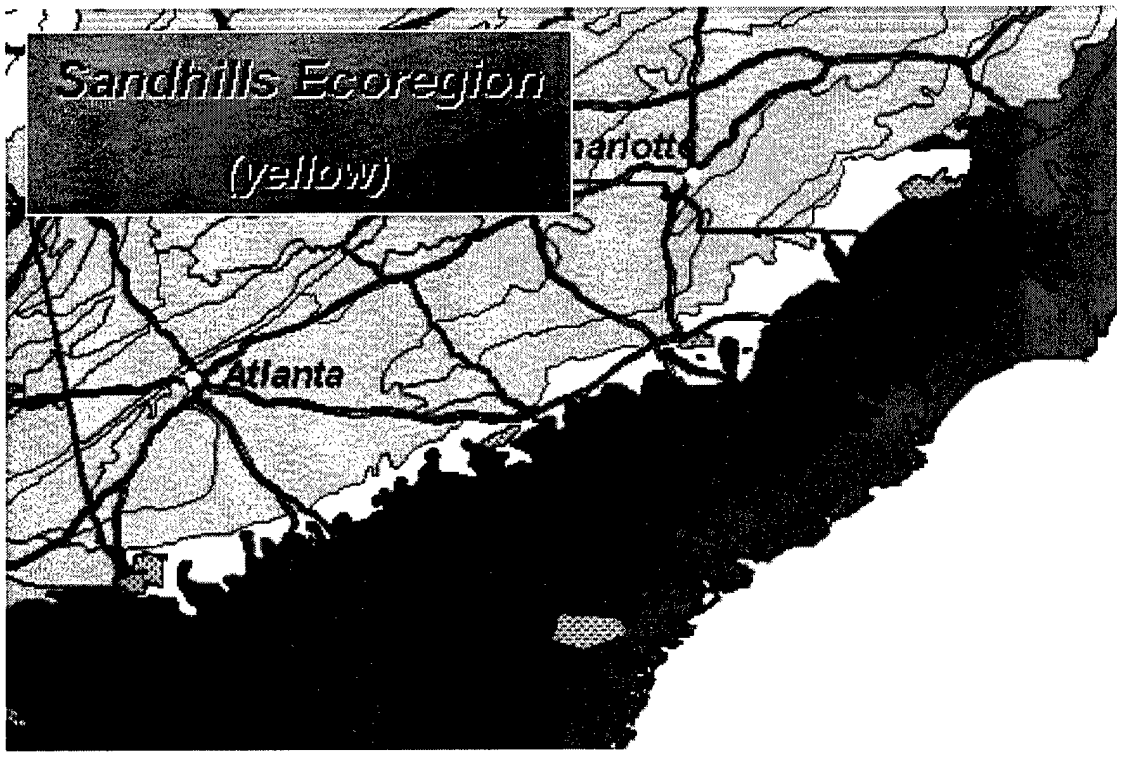

Construction Engineering Research Laboratory

Foreword

This study was conducted for the Strategic Environmental Research and Development Program (SERDP) Ecosystem Management Project (SEMP), under project CS-1114, "SERDP Ecosystem Management Program (SEMP)." The technical monitor was Dr. Robert Holst, SERDP Program Manager.

The work was performed by the Ecological Processes Branch (CN-N) of the Installations Division (CN), Construction Engineering Research Laboratory (CERL). The CERL Principal Investigators were Dr. Harold E. Balbach and Dr. Robert C. Lozar. Thanks to Beverly Collins of Savannah River Ecology Laboratory for helping in the Workshop organization. The technical editor was Gloria J. Wienke, Information Technology Laboratory. Stephen Hodapp is Chief, CEERD-CN-N, and Dr. John Bandy is Chief, CEERD-CN. The associated Technical Director is Mr. William D. Goran. The Director of CERL is Dr. Alan W. Moore.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Commander and Executive Director of ERDC is COL John W. Morris III, EN and the Director of ERDC is Dr. James R. Houston.

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1 Introduction

Background

The Strategic Environmental Research and Development Program (SERDP) is a partnership of the Department of Defense (DoD), Department of Energy (DOE), and Environmental Protection Agency (EPA). The SERDP Ecosystem Management Project (SEMP) was established as a new SERDP initiative in Fiscal Year (FY)98 with two primary goals:

- To establish one or more sites on DoD facilities for long-term ecosystem monitoring, and
- To pursue ecosystem research activities relevant to sustaining DoD mission capabilities.

The overall program objective is to plan, coordinate and manage, on behalf of SERDP, an ecosystem management project initiative that focuses on ecosystem science relevant to DoD ecosystem management concerns. This includes:

- Addressing DoD requirements and opportunities in ecosystem management research, as identified by the 1997 SERDP Ecosystem Science Workshop;
- Establishing and managing one (or more) long-term ecosystem monitoring sites on DoD facilities for DoD relevant ecosystems research;
- Conducting multiple ecosystem research and monitoring efforts, relevant to DoD requirements and opportunities, at these and/or additional facilities; and
- Facilitating the integration of results and findings of research into DoD ecosystem management practices.

The project manager for SEMP is Dr. Hal Balbach, located at the U.S. Army Construction Engineering Research Laboratory (CERL), part of the U.S. Army Engineer Research and Development Center (ERDC).
(hal.e.balbach@erdc.usace.army.mil)

A SERDP Ecosystem Science Workshop, held in 1997, helped to identify some of the critical knowledge gaps in understanding ecosystem status, especially as

they relate to military landscapes. The primary themes that emerge from the workshop include:

- Ecosystem health or change indicators,
- Thresholds of disturbance,
- Biogeochemical cycles and processes, and
- Ecosystem processes as they relate to multiple temporal and spatial scales.

As a follow-up, another workshop was held at the Savannah River Ecology Laboratory, Aiken. SC, on March 6 and 7, 2001. This workshop was titled: "Partners Along The Fall Line: Sandhills Ecology & Ecosystem Management Workshop." The workshop was sponsored by the SERDP SEMP. The SEMP provides funds for monitoring and research to inform ecosystem management at a focal site, Fort Benning, near Columbus, Georgia. The SEMP Ecosystem Characterization and Monitoring Initiative (ECMI) is designed to characterize long-term spatial and temporal dynamics of key ecosystem properties and processes at Fort Benning. Five research teams are focused on two areas: (1) determination of indicators of ecological change and (2) ecological disturbance in the context of military landscapes. (Additional information is available at: http://www.denix.osd.mil/denix/Public/Library/SEMP/semp.html).

One goal of the SEMP is to transfer the technology developed at Fort Benning to other installations and managed landscapes in shared ecoregions, with a special focus on the Fall Line Sandhills region that stretches across Georgia into the Carolinas, just coastward of the Piedmont.

DoD installations, other federal and state-managed lands, and corporate lands are interspersed throughout this region. These lands share ecosystem management issues, including management of federally endangered species such as the red-cockaded woodpecker, and restoration of forest and wetland ecosystems. The Workshop provided an opportunity to discuss these issues, share information, and develop partnerships for research and ecosystem management.

Objectives

The planned Workshop had three major goals:

1. To share ecosystem management approaches, information, and technologies between participating land managers;
2. To explore the potential for ecoregional management and research strategies in the Fall Line Sandhills region; and

3. to share and transition the results of SEMP activities at Fort Benning, GA to other land managers across similar ecoregions.

Workshop Background

The purpose of the workshop was to explore ways to extend benefits from the research and monitoring activities at Fort Benning, GA (and elsewhere in the region of interest) to other managed lands (DoD and non-DoD) that share ecoregional attributes. This primary concept was to nurture and inform ecoregional partnerships that can exchange information and technology approaches related to ecosystem management. These partnerships would then develop shared goals and objectives for their respective lands and for the entire ecoregion.

The workshop provided the opportunity to:

1. Introduce the participants
2. Set the framework through a series of presentations showing similar efforts and research already in place
3. Carry on a series of break out sessions in which participants could discuss perceptions, problems, identify commonalities and opportunities.
4. Present a summary of the breakout sessions to the group.
5. Generate a series of recommendations and actions as the way forward.

Scope

The "Partners Along The Fall Line: Sandhills Ecology and Ecosystem Management Workshop" addresses only projects associated with the Sandhills Ecosystem management questions as they relate to military installations and concerned other governmental agencies and land management organizations. This report does not attempt to address projects and issues associated with other ecosystems or applications beyond the concern of land managers within the Sandhills-type environments.

Mode of Technology Transfer

This report documents the presentations and discussions of the "Partners Along The Fall Line: Sandhills Ecology and Ecosystem Management Workshop." It is intended as a milepost in the road of good land management practices and is

expected to encourage similar activities and research presentations and papers by the participants and their respective agencies.

This report will be made accessible through the World Wide Web (WWW) at URL: http://www.cecer.army.mil/

2 White Paper: Concept for Expanding SEMP Investment Along the Fall Line

Background

SERDP has initiated a project focused on addressing science and technology requirements for ecosystem management of DoD military installations. This project, entitled the SERDP Ecosystem Management Project, is currently hosted at Fort Benning, GA (https://www.denix.osd.mil/denix/Public/Library/SEMP/semp.html). Fort Benning is situated in southwestern Georgia, just below the fall line, along the sandhills region that extends from Alabama into North Carolina.

Figure 1. Training at an installation in the Sandhills in the Southeastern United States.

Several research efforts are underway at Fort Benning. One set of three SEMP direct-funded research teams is focusing on identifying ecosystem change indicators. A second set of research teams is focusing on understanding disturbance with the ecosystem, especially the thresholds for disturbances resulting from military mission activities and land management practices. Another closely related project, funded by SERDP but not formally part of SEMP, will identify the impacts of upland and riparian disturbances resulting from military activities and evaluate possible riparian restoration strategies. In support of these research projects are two ERDC initiatives. The Ecological Characterization and Monitoring Initiative is the first initiative. The ECMI team works with the host installation to gather, assess, and document historic and current ecological data sources and monitoring efforts. This team is also responsible for long term ecological monitoring. The second initiative, the Data Repository, stores information on all the characterization and monitoring efforts in a common data repository. All teams and the installation managers share this data. A related study (not funded through SEMP) involves studying urban dynamics in the immediate vicinity of Fort Benning. These research teams from Oak Ridge National

Laboratory, University of Florida, University of Georgia's Savannah River Ecology Laboratory, and the ERDC are working at Fort Benning, collaborating on strategies for selection of research sites, sharing common review forums, and contributing data into a common data repository. These research projects are designed to provide knowledge, tools, and techniques to enhance sustainable mission use and stewardship of military installation and to contribute to understanding and enhancing the ecological role of military installation within their ecoregions.

SEMP has three major components: (1) creating long term monitoring site(s) on DoD lands, to observe trends over time, (2) establishing research projects aimed at gaining a better understanding of the roles of DoD military mission activities and land management practices at various spatial and temporal scales, and (3) analyzing results of research and monitoring and incorporate new knowledge into host site and other sites land management practices. However, the current SEMP investment is focused almost entirely at Fort Benning and the immediate vicinity. A strategy is needed now to extend the benefits from this investment to those DoD (and non-DoD) managed landscapes that are "most like" Fort Benning in ecoregional characteristics, and to better understand ecosystem management issues that extend from the installation to the ecoregion.

During the characterization or assessment phase for SEMP, in which the region of interest was defined, The Nature Conservancy was asked to provide an ecoregional context for Fort Benning. The Southeastern Regional Office of The Nature Conservancy, under the direction of Mr. Chuck Bassett, used various sources to best define the ecoregion, including a U.S. Department of Agriculture (USDA) Forest Service source (Keys et al. 1995*) entitled Ecological Units of the Eastern United States. This source, is represented in Figure 2. The sandhills area is shown in yellow.

* J. Keys Jr., C. Carpenter, S. Rooks, F. Koenig, W.H. McNab, W. Russell, and M.L. Smith, 1995, *Ecological Units of the Eastern United States – First Approximation,* U.S. Department of Agriculture, Forest Service, National Forest System, Atlanta, GA.

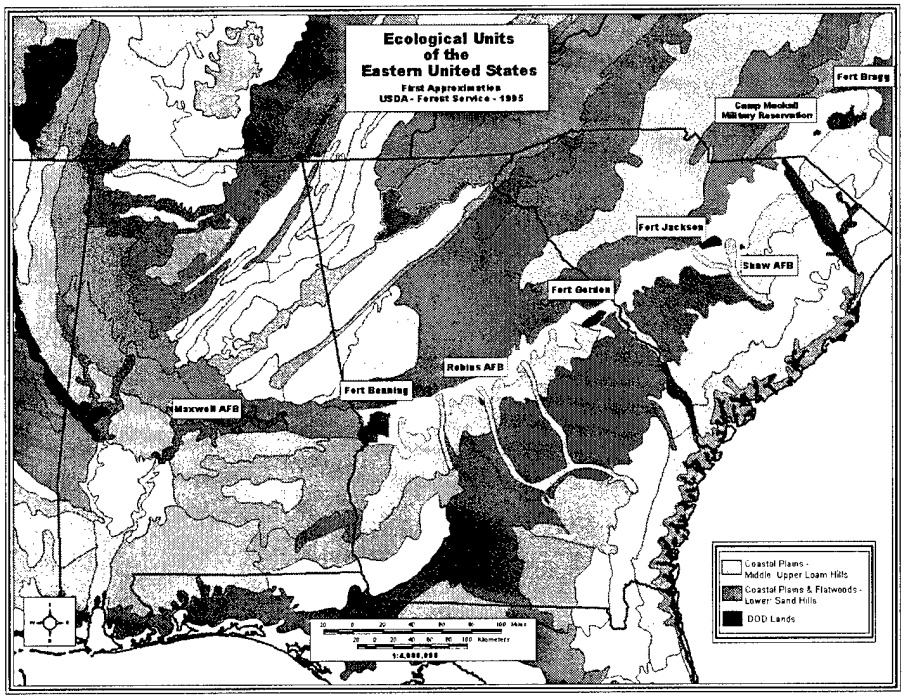


Figure 2. Ecological units of the Eastern United States with DoD installations along the fall line.

This source indicates that there are similar ecological characteristics to a relatively long stretch of land, extending all the way across Georgia and north across the Carolinas. Of particular note, when viewing this map, is the significant investment of the DoD in land holdings (noted in bright red, with labels) all along the fall line. This area is a region of generally sandy, low fertility soils that were formerly longleaf pine forests. In most cases, the original forests were harvested, and then the land was farmed. Often, the farmers taxed the low nutrient lands beyond their capacity, and the land's economic value diminished. Then, during the World War I and World War II, the Defense Department acquired (and has retained) many holdings along this fall line region.

The future of this region needs to be considered within the broader context of the Southeastern United States. Because of relatively low soil fertility in this fall line region, pressure for more intense agricultural land use and for urban expansion will likely occur in more fertile areas further coastward on the coastal plain. For this reason, it would be easier and less expensive for conservationists to target the fall line region to help achieve some important national and regional conservation goals. An example of such a goal would be preserving and enhancing protected species habitats. As a significant land holder in the region, the DoD needs to anticipate and help shape future land use pressures — to ensure that defense mission requirements continue to be met while conservation goals are pursued.

Given the current investment at Fort Benning, and the high level of related DoD holdings all along the sandhills region, several steps seem appropriate. Of primary importance is to begin a dialogue of ecoregional land managers. This dialogue will move activities along according to the emphasis and concerns of these regional land managers. The following are critical "next steps" for SEMP:

- *Characterize the Ecoregion* Any ecosystem management issues, relevant to the region, will require an understanding of the baseline data and conditions in the region. This can be a massive effort (as was the case in the Mojave Desert*) or it can be a rather modest gathering of existing data, with interactive decisions to "fill in the gaps" as pressing issues and resulting gaps emerge. Such an approach ensures that data collected and organized will be data used for specific applications (and then managed for future applications). The Nature Conservancy effort resulted in no more than an ecoregional map. One critical assessment that is needed relates to land ownership patterns in the ecoregion; the results of this assessment can help formulate early gatherings of land managers. A "modest" beginning level assessment could yield three products: (1) an assessment of data holdings and shortfalls, (2) a set of recommendations on shortfalls (e.g., a prioritized list of critical data gaps and data integration issues), and (3) a set of data required to help establish a "baseline" or point in time condition assessment.

- *Analyze Ecoregional Trends* The critical point, when gathering data about an ecoregion, is to understand current conditions and trends. Many organizations are already developing techniques to study conditions and trends on the ecoregional level, and the fall line effort should employ these techniques (e.g., from the EPA, The Nature Conservancy, and others). What are the forest/urban/agricultural and other land uses patterns in the region? How are these land use patterns changing over time? What percentage of this region is being converted to urban/suburban uses, at what rate? What's the distribution and role of public holdings in the region, and how do these holdings relate to changes in the region? What are the trends with regional water and air quality, and how can data from SEMP (and other federal sites) be nested into this regional understanding? What are the compatibility/integration issues of data holdings from different programs/sources/techniques?

* http://www.mojavedata.gov/mdep/partners.html

- *Examine Ecotonal Transitions* The map developed by The Nature Conservancy illustrates numerous ecoregions in the Southeastern United States. Many factors separate one ecoregion from another, but numerous shared attributes extend across ecoregions. In the case of the region along the fall line, it appears that there are some relatively sharp transitions to the north and east, toward the mountains, and many shared attributes with those regions towards the coastlines. This analysis should be focused on defining attributes shared between ecoregions — to better understand natural alliances in planning and information exchange between entities in these regions. Also, this understanding is especially important as candidate sites for "proof of principle" testing of research results from one site to another. The analysis should not require additional field data collection, but may involve some evaluation of such attributes as shared soil types or landscape feature types across ecotones. Remote Sensing (RS) and Geographic Information System (GIS) techniques can be applied to the definition of transitional areas. Using RS and GIS is also likely to define similar areas that are spatially distant but statistically related to the Sandhills transitional areas. This initiative might be broadened to include comparisons from major monitoring/research sites in adjoining ecoregions (e.g., Koweta, Benning, and the Savannah River Site) and such an effort may be of interest to National Science Foundation.

- *Nurture Dialogue Along the Fall Line (hold initial forums)* Key to establishing some ecoregional perspective related to the fall line region is to nurture a dialogue of regional managers. Forums are needed to: (1) ensure that land managers along the ecoregion are informed about research investments and results from SEMP and other programs so they can plan for and benefit from these results, (2) develop a sense of context and identity necessary for sharing plans and information across the ecoregion, and (3) develop strategies to set goals and monitor progress for this and neighboring ecoregions. These forums can take several expressions — from regional workshops and cross-site visits and demonstrations to teleconferences and sharing across websites. Lessons learned from other ecoregional forums should form an important element in plans for gathering regional ecosystem managers.

- *Characterize Selected Managed Units* Before proof-of-principle testing or general adaptations occur across sites, some level of effort is needed to compare and contrast these sites and understand local differences and adjustments that might be necessary for the proposed testing and/or adaptation. This context information is needed for monitoring protocols, management techniques, landscape rehabilitation, or ecological engineering activities. The level of detailed context information required is an important part of the adaptability of any technique or method — with those approaches requiring

the least amount of context data having a "leg up" on other approaches. Thus, this requirement should be limited in scope, and should be met within the context of transition/transfer of objectives for specific approaches — however, such information provides an important "background database" component of understanding regional ecological dynamics at both the regional and management unit scales.

- *Test and Transition Results/Techniques* The research investment at Fort Benning (and elsewhere along the fall line) has a high potential for producing results that could be of value to other managed land holdings (e.g., installations, public and/or private forests, parks) in the region. Transitioning results from the SEMP investment needs to include an understanding of the shared as well as the differing characteristics between managed holdings across the ecoregion. Strategies need to be developed by the various land managing entities in the ecoregion to identify and prioritize those results that are of greatest interest for testing and adaptation.

- *Explore Transitions Along Spatial and Temporal Scales* Ecoregional issues of concern (such as decreasing patches sizes for forest stands or increasing patch sizes for impervious surfaces) require tools and techniques to move between and across spatial and temporal scales. While some variables and indicators work only at specific scales, other variables can be expressed for an entire ecoregion and also can be scaled down to managed landscapes or groups of managed landscapes (such as a national forest or military installation) within the ecoregion, to even smaller management units (e.g., forest stands, training areas) within the boundaries of a managed landscape. One of the key goals of this effort is to identify what status indicators and management adjustments can easily translate across scales and to develop procedures to properly review, interpret, and present these indicators across temporal and spatial transitions.

Status

Currently, various SEMP research projects are already underway at Fort Benning, and a monitoring program is being implemented. The monitoring will focus on watersheds data at three scales — with the broadest scale being the hydrologic unit code (HUC) of watershed units that include Fort Benning and the

surrounding region (HUC 03130003*). Data collection will involve water quality, weather, and soils data from field sampling sites, and imagery from various satellite sources. All field data collection will occur within the boundaries of Fort Benning (identified in red in Figure 2), but the satellite data will include information across the HUC. Figure 3 illustrates HUC 3130003, which corresponds to the Regional Scale of the Benning monitoring plan. (The Fort Benning boundary is in red; rivers in blue; and the major watersheds outlined in black.)

In addition to the Fort Benning monitoring and research activities, an effort to generate a historic land use characterization over the entire Sandhills region (including a buffer) has been initiated. Mr. Robert Lozar of ERDC-Champaign has awarded a contract to Hunter College of New York City to develop the digital land use maps derived from Multi-Resolution Land Cover (MRLC) data developed by the USGS for the mid-1990s and from the North American Land Cover (NALC) Landsat images compiled by the EPA for each decade from the 1970s. This regional geographic database will be used to begin to understand the ecological status of the region, using EPA's indicator techniques. Hunter College staff have developed a unique software algorithm to identify historical land use changes using the NALC and MRLC data. The purpose of the data is to set a standard for monitoring land use changes over a long time horizon.

The data for the Sandhills includes:

- MRLC
- Generated Land Cover data for
    - 1970's
    - 1980's
    - 1990's
- Contextual data
- Metadata descriptions

The data distribution will be on published on CD-ROM. Format will be a GIS standard format. This investment begins to address the first two items on the list of the critical "next steps" for SEMP (Characterize the Ecoregion [p14] and Analyze Ecoregional Trends [p 14). A follow-on task will refine the data for distribution to the SEMP community. When completed, it will represent only a be-

* For a more complete discussion of watershed characteristics, please see Graves, M. R. (2001). *Watershed Boundaries and Relationship Between Stream Order and Watershed Morphology at Fort Benning, Georgia*, ERDC/EL TR-01-23, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

ginning for each task — but this effort should provide a foundation to build upon in fiscal year 2002 and beyond.

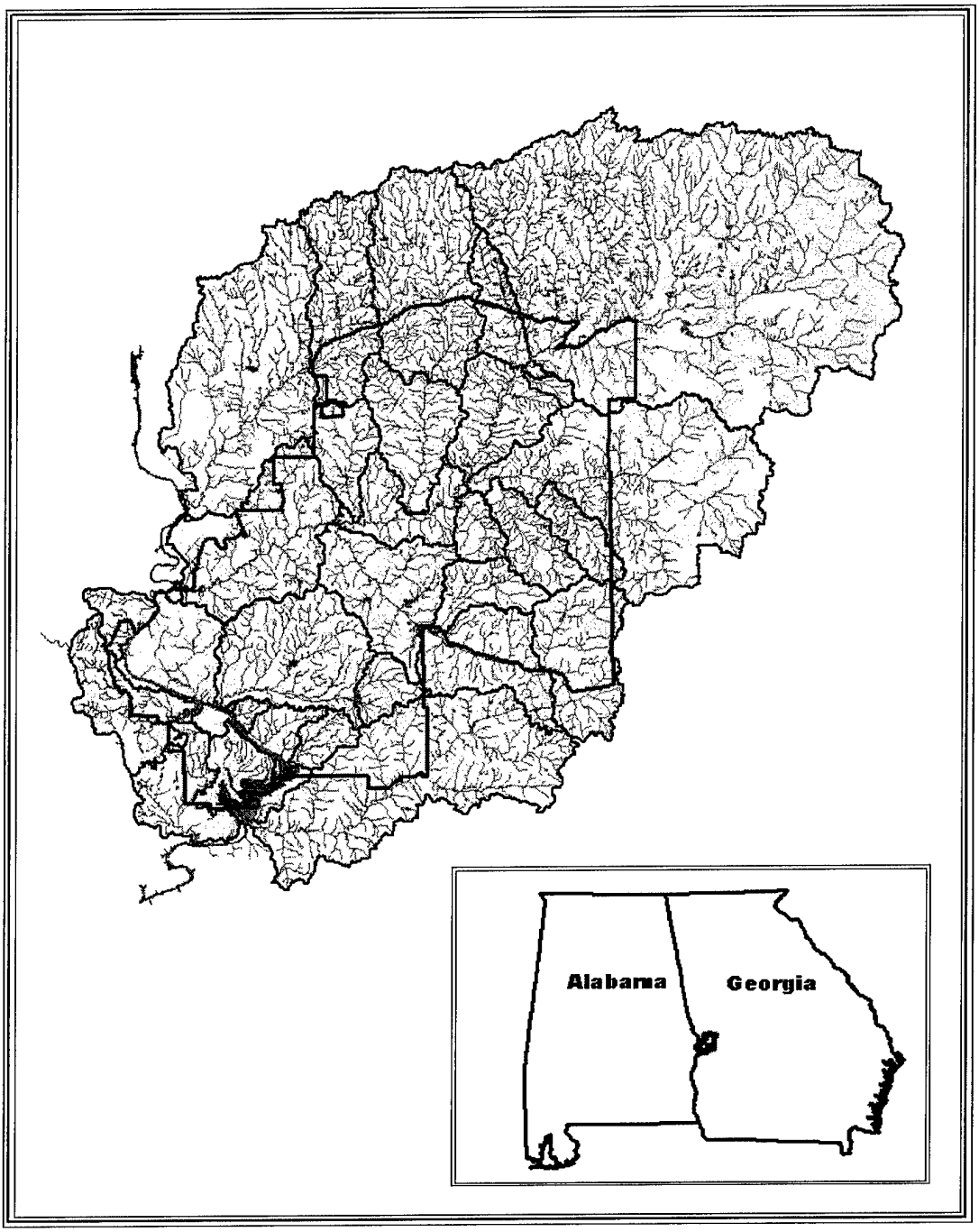


Figure 3. A possible example of a Fort Benning "Regional Scale" study area. The Fort Benning boundary is in red; rivers in blue; and the major watersheds outlined in black.

Proactive Opportunities

The DoD has been proactive in furthering national and regional goals related to ecosystem management and ecoregional planning. The current SEMP investment, and the natural extension of this investment to other DoD and non-DoD holding along the Fall Line Sandhills is an outstanding opportunity for DoD programs and facilities. Some of the "high risk — high cost" components of this investment have already been undertaken. Efforts are needed now to create forums between land managers along the fall line and to begin developing strategies to share and test results and plans and techniques.

This is a good opportunity for synergism between two DoD programs — SERDP and the Legacy Resource Management Program. Each program can extend the value of the other by partnering in an investment along the fall line — with Legacy pursuing ecoregional management and sharing goals and SERDP helping to move technology from researcher's plots to DoD management programs. In addition, DoD programs can help build a base for synergism for other national and regional organizations (such as Forest Service, National Science Foundation, U.S. Dept of Interior, etc.) to leverage. This concept also dovetails with national and regional emphasis of The Nature Conservancy, and TNC stands ready to partner with DoD and others to help pursue this opportunity.

3 The Workshop Preparation

The Steering Committee

To initiate the concept of the Fall Line Workshop, a steering, or advisory, committee was formed in early September 2000. The members of this group included Beverly Collins, Savannah River Ecology Laboratory (SREL); Hal Balbach, ERDC/CERL; Hugh Westbury, ERDC (Housing Support Center at Fort Benning); Nancy Herbert, U.S. Forest Service (USFS); Eileen Regan, Hydro-GeoLogic, Inc. (HGL) and SERDP; Bob Sargent, Robins Air Force Base (AFB), GA; George Carellas, Southern Regional Environmental Office (SREO); and John Hall, The Nature Conservancy (TNC). The committee had several charges. They were to: (1) establish dates for the workshop, (2) set an agenda, (3) prepare a suitable letter announcing the workshop and inviting participation, and (4) nominate persons and organizations to receive these invitations, either to present or to participate through attendance.

Dates for the workshop were established in early October through SREL and discussions with their Director's office. A Tuesday-Wednesday alignment was selected to allow participants a day to travel to Aiken before the start of the workshop. By late October, an invitation format had been prepared by Dr. Collins and her staff, and reviewed by the committee. This invitation is shown in Appendix A.

By mid-November, a list of more than 80 potential participants had been developed following nominations by the committee, the SERDP Program Office, the SEMP research team, Fort Benning staff, and others. An invitation was sent, largely by e-mail, to these persons and organizations in early December 2000. Following this first round of invitations, many names were added as a result of suggestions from initial invitees.

The agenda proved a more difficult challenge. Using suggestions from the committee and other sources, Hal Balbach and Beverly Collins developed several versions that were distributed for review and comment. It was difficult to balance the desire to include examples that show alignment with known regional needs against valuable examples of successful regional planning from other parts

of the United States. The desire to present SEMP in exactly the right light was also a challenge.

In the long run, it was decided to de-emphasize SEMP itself, and concentrate on those aspects of SEMP that appeared to relate to the regional interests of the participants. The working agenda was prepared the last week of February and sent to the registered participants. A copy of the final agenda follows.

The Agenda:

March 6 (Tuesday)

0815	Welcome	Whit Gibbons
0820	Introductions	
0830	Ecosystem Management Challenges in the Region	
	How does SEMP fit in?	
	Purpose of Workshop	Hal Balbach/ Bill Goran
0915	Ecosystem management and research on the Savannah River Site	
	Where are you and why are you here?	
	Contributions from 50 years of ecological research	Rebecca Sharitz
	An overview of Forest Service resources management	Don Imm
0945	Origin and Goals of SEMP—DoD Perspective	Bradley Smith
1000	Origin and Goals of SEMP—Research Perspective	Virginia Dale
1015	Break	
1045	Fall Line Ecoregional Data Development	Bob Lozar
1115	The Southern Appalachian Assessment	Charles VanSickle
1145	Cooperative Efforts of the Southeastern Natural	
	Resource Leaders Group Using the Southeastern	
	Ecological Framework	Neil Burns
1215	Lunch	

1300	Regional Ecosystem Management Program in the Southeast	
	An example from the Gulf Coast	Rick McWhite
1330	Presentation (Eglin)	John Hiers
1400	Regional Ecosystem Management Planning in the Southwest:	
	An example from the Sonoran Desert	John Hall
1430	Structure and Progress of SEMP Research	Hal Balbach
1500	A Tool for Ecosystem Management	Legacy
1530	Break and time to peruse displays/demonstrations	
1600	Discussion	
	What can we learn from each other?	Bill Goran/ Kay McGuire
	Are the lessons learned from other regions applicable here?	
	Identify common issues - list and modify topics for Wednesday sessions.	
1700	Social	

March 7 (Wednesday)

0830	Summary of Day 1 (in brief)	Hal Balbach
0845	Finalize working group topics and groups	Kay McGuire
0915	Break	
0930	Break into flexible working groups based on identified topics	
	Prepare reasonable objectives for exploration during 2001-2002	
1130	Lunch at SREL	
1330	Groups Report to Conference	
1500	Facilitator Summarizes Primary Points	Kay McGuire
1530	Future Plans for Action and Meetings	Hal Balbach/ Bill Goran
1600	Adjourn	

Representative Organizations at the Workshop

Camp Lejeune Fish and Wildlife Division
Camp Shelby Field Office
Clemson University
Department of the Army - Fort Gordon
Department of the Army - Fort Jackson Wildlife Office
Department of Energy, Headquarters
DoD – Strategic Environmental Research and Development Program
Engineer Research and Development Center/Construction Engineering Research Laboratory
Eglin Air Force Base, FL
Fort Benning Army Installation
Los Alamos National Laboratory
Mississippi Army National Guard
National Council for Air and Stream Improvement, Inc.
Oak Ridge National Laboratory
Southern Appalachian Man and Biosphere
Savannah River Ecology Laboratory
SERDP Ecosystem Management Project
Shaw Air Force Base, SC

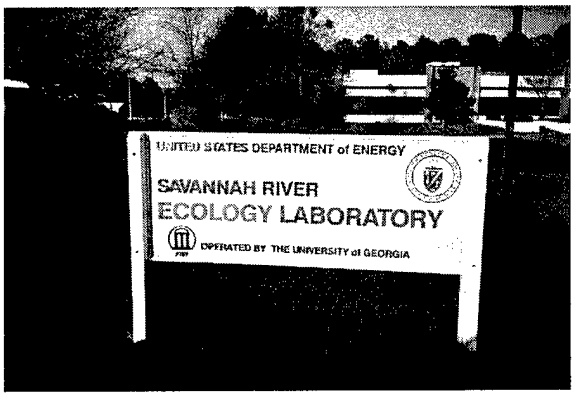


Figure 4. Savannah River Ecology Laboratory, the host organization.

The Nature Conservancy
U.S. Army Southern Regional Environmental Office
U.S. EPA
US Fish & Wildlife Service
U.S. Forest Service - Atlanta, GA
U.S. Army Signal Command & Fort Gordon
U.S. Department of Agriculture Forest Service - Institute of Tree Root Biology
USDA Forest Service - Southern Research Station

Presentors at the Workshop

Hal Balbach
Senior Research Biologist
ERDC/CERL
P O Box 9005
Champaign, IL 61826-9005
217.373.6785 / 217.373.7266, fax
hal.e.balbach@erdc.usace.army.mil

Neil Burns
Ecologist/Spatial Analyst
US EPA Region 4
OPM-Planning and Analysis Branch
61 Forsyth Street
Atlanta, GA 30303
404 562.8289 / 404.562.8269
Burns.Neil@epamail.epa.gov

Virginia Dale
Oak Ridge National Laboratory
P O Box 2008
MS6036
Oak Ridge, TN 37831-6036
865.576.8043 / 865.576.8543, fax
VHD@ornl.gov

Whit Gibbons
Senior Ecologist
UGA Savannah River Ecology Lab
P O Drawer E
Aiken, SC 29802
803.725.2472 / 803.725.3309, fax
Gibbons@srel.edu

Bill Goran
Technical Director
ERDC/CERL
P O Box 9005
Champaign, IL 61826-9005
217.373.7202 / 217.373.6776, fax
william.d.goran@ erdc.usace.army.mil

John Hall
The Nature Conservancy
1510 East Fort Lowell Rd
Tucson, AZ 85719
520.547.3439 / 520.620.1799, fax
John_Hall@tnc.org

James Hanula
USDA Forest Service
Southern Research Station
320 Green Street
Athens, GA 30602-2044
706.559.4253 / 706.559.4287, fax
JHanula@fs.fed.us

John Hiers
Eglin Air Force Base
107 Highway 85 North
Niceville, FL 32578
850.882.4164 ext 309 / 850.882.5321, fax
HiersJK@eglin.af.mil

Don Imm
Savannah River Institute
P O Box 700
New Ellenton, SC 29809
Dimm@fs.fed.us

Stephen C. Laine
Eglin Air Force Base
107 Highway 85 North
Niceville, FL 32578
850.882.4164 ext 367 / 850.882.5321, fax
LaineS@eglin.af.mil

Robert Lozar
Community Planner
ERDC/CERL
P O Box 9005
Champaign, IL 61826-9005
217.352.6511 ext 6367 / 217.373.7266, fax
robert.c.lozar@erdc.usace.army.mil

Kay McGuire
Acting Branch Chief
ERDC/CERL
P O Box 9005
Champaign, IL 61826-9005
217.373.7218 / 217.373.7222
kay.c.mcguire@erdc.usace.army.mil

Rick McWhite
Eglin Air Force Base
107 Highway 85 North
Niceville, FL 32578
850.882.4164 ext 301 / 850.882.5321, fax
McWhiteR@eglin.af.mil

Kenneth W. Outcalt
U. S. Forest Service
Southern Research Station
320 Green Street
Athens, GA 30602
706.559.4309 / 706.559.4311, fax
KOutcalt@fs.fed.us

Rebecca Sharitz
UGA Savannah River Ecology Lab
P. O. Drawer E
Aiken, SC 29802
803.725.2472 / 803.725.3309, fax
Sharitz@srel.edu

Bradley Smith
DoD-SERDP
901 N. Stuart St, Ste 303
Arlington, VA 22203-1821
Bradley.Smith@osd.mil

Charles VanSickle
Southern Appalachian Man and
Biosphere
19 Nottingham Drive
Candler, NC 28715
828.665.2422
CVans@prodigy.net

Attendees

See Appendix B for a list of the attendees.

4 Workshop Presentations

The following pages provide briefing materials presented at the Partners Along The Fall Line: Sandhills Ecology & Ecosystem Management Workshop. Each section provides the presenter's name, the abstract, and the presentation materials.

Ecosystem Management Challenges in the Region

PRESENTERS: Bill Goran and Harold Balbach

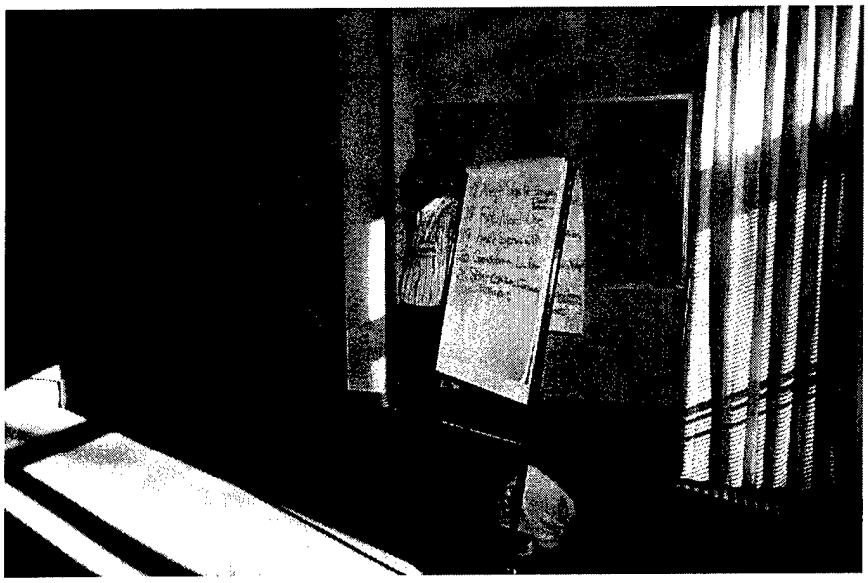


Figure 5. Bill Goran presents the plan.

ABSTRACT: The original idea to have this workshop was generated as part of the SERDP Science advisory group discussions. That group consisted of Peter Boice, Dan Bokin, Virginia Dale, Doug Ripley, and Chuck Bassett. The SEMP work was initially focused at the installation scale, in this case to Fort Benning because of their enthusiastic willingness to cooperate in this research effort. However, the view became increasingly important as we began to get our feet off the ground at Fort Benning, "How can we make the benefits of the SEMP research investment more widely available to other military installations, particularly between services, and other governmental and private organizations that were facing similar questions in land management and monitoring situations?"

By defining the Sandhills as a focus area, as illustrated by the posters at the workshop, and recognizing the common concerns of the stakeholders in this region, we hope to begin to address that question at this workshop. We hope from this workshop will arise an on-going effort among the participants to discuss the SEMP research and define opportunities for its application at their locations and thus begin to provide a greater benefit to the military, to the Federal government, and to the organizations and individuals who will be affected by our land management decisions in the future.

Ecosystem Management and Research on the Savannah River Ecology Laboratory

PRESENTERS: Rebecca Sharitz and Beverly Collins

ABSTRACT: The University of Georgia's Savannah River Ecology Laboratory (SREL) was pleased to host the Partners Along the Fall Line Sandhills Ecology and Ecosystem Management Workshop. It was most appropriate for this workshop to meet at SREL, on the Department of Energy's Savannah River Site (SRS), since SREL has a legacy of 50 years of ecological research on the management of federal lands in the sandhills region of the Southeast. Furthermore, the SRS shares many ecoregional attributes with Fort Benning and other Department of Defense sites of interest to the SERDP SEMP program.

PRESENTATION: Ecosystem Management and Restoration on the Savannah River Site

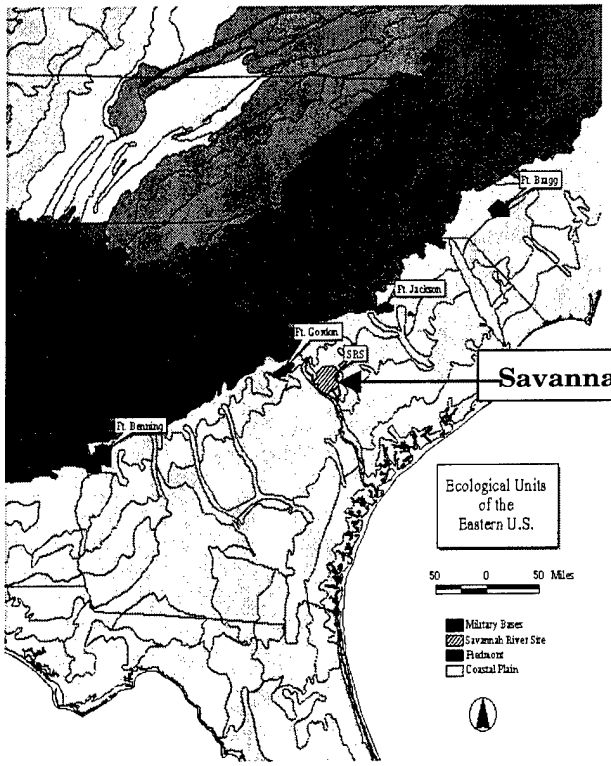
Ecosystem Management and Restoration on the Savannah River Site: Contributions from 50 Years of Ecological Research

Rebecca Sharitz and Beverly Collins
Savannah River Ecology Laboratory
University of Georgia

The University of Georgia's Savannah River Ecology Laboratory (SREL) was pleased to host the ***Partners Along the Fall Line Sandhills Ecology and Ecosystem Management Workshop***. It was most appropriate for this workshop to meet at SREL, on the Department of Energy's Savannah River Site (SRS), since SREL has a legacy of 50 years of ecological research on the management of federal lands in the sandhills region of the Southeast. Furthermore, the SRS shares many ecoregional attributes with Fort Benning and other Department of Defense sites of interest to the SERDP SEMP program.

GOALS:

- **Provide an overview of the ecology of the SRS, and of the land management practices and challenges during the past half century.**
- **Show how the SRS, using the extensive body of information that has been collected on the site during the last 50 years, can contribute to the SERDP SEMP mission of exchanging information and technology approaches related to ecosystem management.**



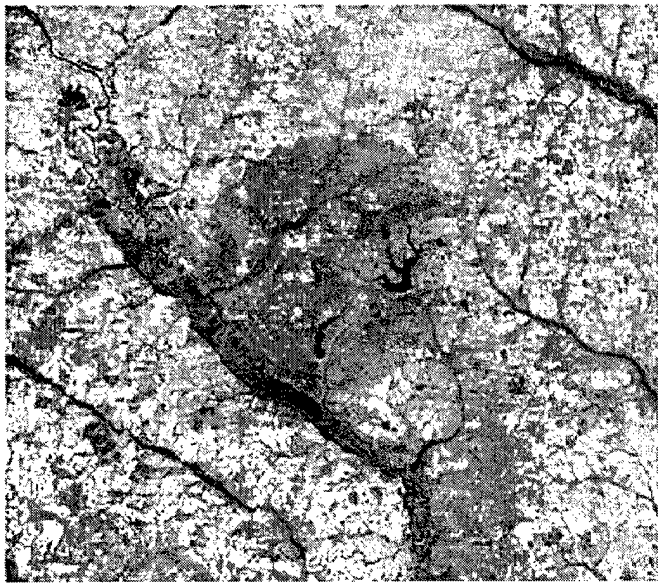
The SRS is a 310 square mile tract of federal land located in west-central South Carolina, just below the fall Line, in the sandhills region. It was acquired by the government in 1950 for construction of an industrial facility that for many years produced nuclear materials for the nation's defense. The non-industrial uplands of the SRS have been managed by the U.S. Forest Service (USFS-SR) for multiple uses, such as commercial timber production and wildlife habitat.

Since the early 1950s, studies by SREL scientists, and others, on the SRS have documented that the biodiversity of the site may be greater than that of any other comparably sized area of the southeastern Upper Coastal Plain. There is extensive knowledge and

experience, based on ecological field research on the SRS, about the effects of resource management practices on different ecosystems of the Southeast.

Habitats and Land Use Practices on the SRS

This Landsat Thematic Image of the SRS shows the extensive coverage of pine forests (in dark green), in contrast to surrounding agricultural lands (white and pink) and urban or industrial areas (blue). When the land area was acquired for the SRS, about 67% was forested, 33% was crop or pasture, and most accessible forest stands had been logged (Workman and McLeod, 1990). Today, much of the suitable forest area of the SRS is managed for multiple uses, primarily for commercial timber production, by the USFS-SR. About 69% of the SRS forests are pine plantations and 31% are hardwood stands or mixed pine and hardwoods.



North and central parts of the SRS are located on the Aiken Plateau, which has sandy soils and is deeply dissected by streams. Coastal terraces, which roughly parallel the Savannah River and include its current floodplain (purple), occupy the southwestern part of the site. Plant communities of the SRS are distributed along these topographic and moisture gradients and are heavily influenced by land management.

The SRS as a NERP Site

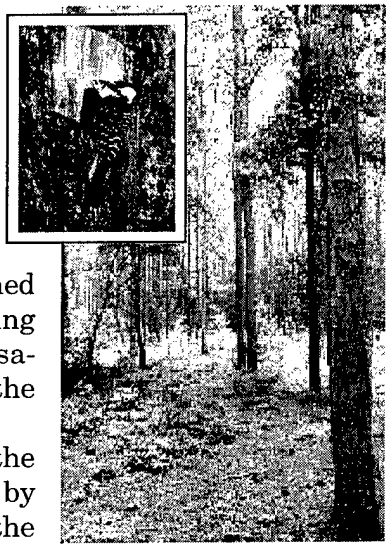
In 1972, the entire SRS was designated as the nation's first National Environmental Research Park (NERP), where the effects of industrial and land management practices on the environment could be studied. Under the NERP program, management of the SRS for forest products and wildlife, and establishment of 30 set-aside areas (totaling 14,005 acres) for baseline monitoring and long-term ecological research, have resulted in a rich diversity of habitats. Here, we highlight the ecology and management of selected ecosystems.

Sandhills

Sandhill communities are typically found on deep sand ridges that are remnants of ancient coastal dunes. The vegetation is adapted to the low soil fertility and moisture of the deep sands, and these forest and shrub communities are subject to periodic fires. The sparse forest canopy is dominated by scrub oaks (*Quercus laevis, Q. margaretta, Q. incana, Q. marilandica*) and longleaf pine (*Pinus palustris*). The understory is patchy, with clumps of Vaccinium shrubs and grasses such broomsedge (*Andropogon* spp.) and three-awned grass (*Aristida* spp.) Most plants of the sandhills resprout or establish from seeds after burning. For example, genetic analysis of deerberry (*Vaccinium stamineum*) revealed that patches of this shrub may be structured by clonal growth and seedling recruitment following fires (Kreher et al. 2000). Approximately 1977 acres of the SRS supports sandhills vegetation. Research by SREL and USFS-SR scientists includes studies of the effects of season of burning and of fire frequency.

Pine Management and Red-Cockaded Woodpecker Habitat

The USFS-SR generates revenue from the sale of forest products, primarily saw logs for lumber, pulpwood for paper, and pine straw for mulch. The value of the standing timber at SRS is over $500 million (USFS-SR, 2000). A low intensity of management is designed to support sustainable resource objectives, which include management for endangered species, ecological and environmental restoration, deer hunts, and a diverse array of forest conditions for nongame wildlife and plants. Harvesting includes thinning, partial-cutting, and clear-cutting. A fire management program by the USFS-SR is designed to manage fire as an ecological process. Prescribed burning also is essential for restoration of native longleaf pine savanna communities and for management of habitat for the federally endangered red-cockaded woodpecker (RCW).



Preservation and enhancement of RCW habitat is the principal wildlife management program being conducted by the USFS-SR. In 1985, there were only 4 RCWs at the

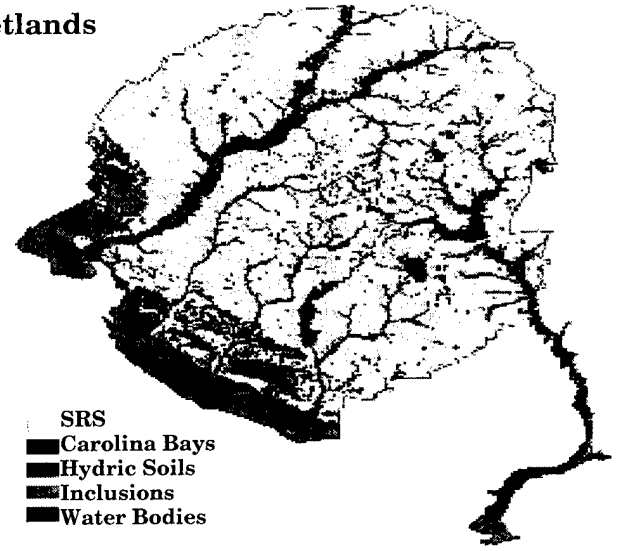
SRS. Estimates of needed foraging territory and of genetic variation and population structure of RCWs by SREL (Skorupa and McFarlane 1976, Stangel 1990) aided the USFS-SR in recovery of the populations, and by 1999, there were 152 birds and 32 clusters. Historically, the RCWs nested in open pine stands in wetlands, because much of the land was in agriculture before the SRS was established. Currently, the colonies are in upland pine forests and management for RCW habitat is toward mature longleaf pine, using mechanical treatments, herbicides, and prescribed burning to control mid-story vegetation. Artificial cavities are also placed in trees and maintained to encourage bird usage.

Hardwoods and Mesic Slopes

Although most hardwood forests on the SRS lands were logged before the site was acquired, hardwood stands remain on bluffs and slopes and in riparian areas along stream drainages. The topography is dissected, and plant communities grade from pine plantations in the uplands, down mesic slopes to stream floodplains. Upland hardwood forests with white oak (*Quercus alba*), southern red oak (*Q. falcata*) and mockernut hickory (*Carya tomentosa*) in the canopy occur on bluffs, especially along Upper Three Runs Creek. Mesic slopes are dominated by sweetgum (*Liquidambar styraciflua*), hickories (*Carya* spp.) laurel oak (*Q.. laurifolia*) and occasional beech (*Fagus grandifolia*). Midstory trees and shrubs on these slopes include dogwood (*Cornus florida*) and sassafras (*Sassafras albidum*). Lower slope communities grade into riparian bottomland forests, with sweetgum and red maple (*Acer rubrum*), laurel oak and water oak (*Q. nigra*), and a variety of other hardwood species forming the canopy.

Studies by SREL researchers of soil nitrogen losses following disturbance in forests across this upland-lowland gradient support the premise that deciduous forests recycle more nitrogen through the plant-soil components than do coniferous ecosystems. Upland pine sites were the most resistant to nitrate leaching losses following disturbance, upland deciduous were intermediate, and bottomland hardwood sites were the least resistant to such losses (Kovacic et al. 1990). Similar research by SREL is currently underway at Fort Benning to evaluate effects of forest management (burning, thinning) and military use on soil nitrogen dynamics (Collins et al. 1999).

Wetlands

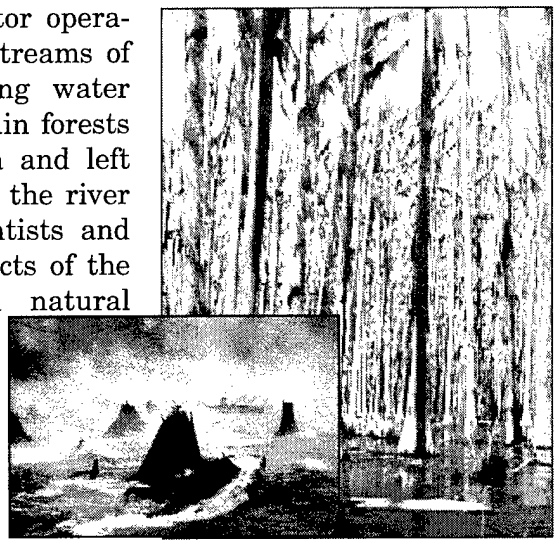


The SRS contains 90% of the wetlands found on all DOE sites. These include extensive areas of bottomland hardwood forests and swamps along the floodplains of the Savannah River and its tributaries (in purple on the map) and in other low-lying areas (light blue). In addition, there are numerous isolated wetlands in Carolina bays or similar depressions (red) scattered constructed to support the SRS industrial operations (blue), and numerous farm ponds and other water bodies (blue). Over the years, extensive research has examined natural ecological processes in wetlands, as well as assessed the responses of wetland ecosystems to disturbances from SRS industrial activities.

Floodplain Wetlands

Canopy dominant species of SRS stream floodplains include laurel oak, water oak, and willow oak (*Quercus phellos*), green ash (*Fraxinus pennsylvanica*), sweetgum, swamp tupelo (*Nyssa biflora*), and red maple. The Savannah River floodplain is a 7500 acre forested wetland that historically consisted of about 50% baldcypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*) swamp, 40% mixed bottomland hardwood stands, and about 10% shrub, marsh and open water. Long-term SREL studies have examined the dynamics of these forests over time (Jones and Sharitz 1998, Jones et al. 1995).

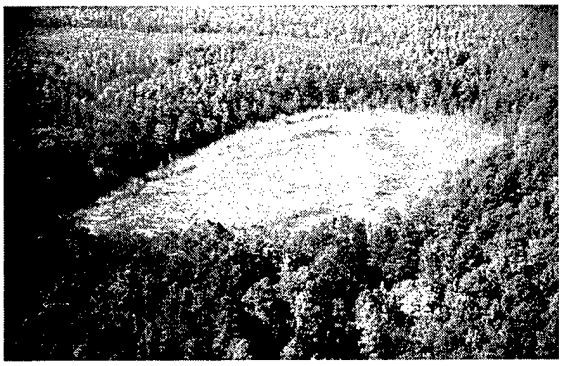
Impacts to Floodplain Wetlands and Restoration



During the earlier period of reactor operations on the SRS, several tributary streams of the Savannah River received cooling water discharges that destroyed the floodplain forests and other riparian and swamp biota and left large areas of standing dead trees in the river floodplain. Research by SREL scientists and others documented the ecological effects of the thermal discharges, and examined natural recovery processes following reactor shut-down (e.g., Sharitz et al. 1974, Gibbons and Sharitz 1981, Sharitz et al. 1990). When reactor operations ceased, attention turned to the restoration of wetland forest communities in these highly disturbed sites. SREL and USFS-SR researchers collaborated with other scientists in studying methods to restore the floodplain forests along Pen Branch and Four Mile Creek, two of the thermally impacted streams (e.g., McLeod 2000, Barton et al. 2000). Research focused on selection of appropriate species and planting techniques for restoration. Tree shelters were required to maximize survival in some areas where beaver herbivory was high. To assess effectiveness of the restoration effort, bottomland reference systems at various states of succession were compared. In addition, long-term studies of natural bottomland and stream floodplain forests provide baseline for evaluating recovery of these disturbed riparian systems.

Carolina Bay Wetlands

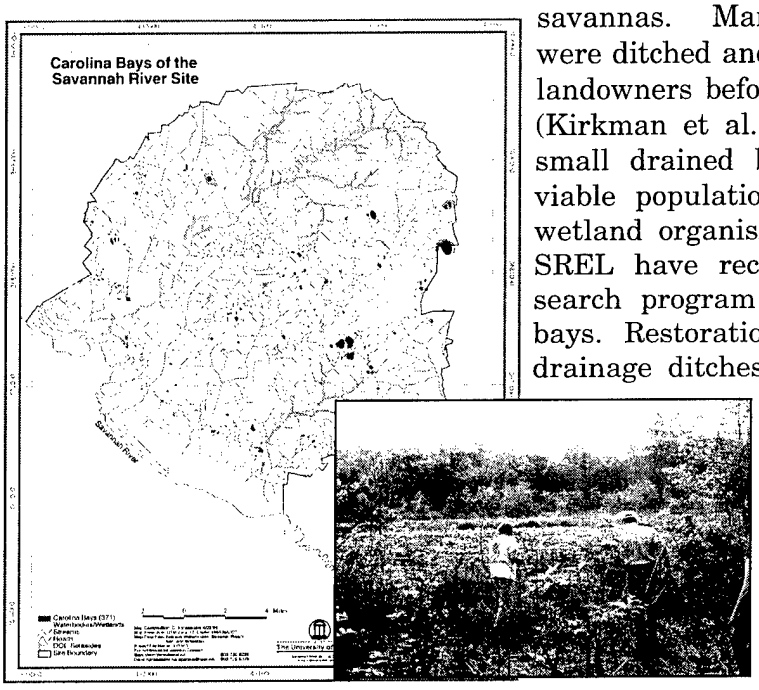
Carolina bays are natural isolated depressions abundant in the southeastern Coastal Plain. They have a characteristic elliptical shape and northwest to southeast orientation, and are often rimmed by low sandy ridges. The hydrology of these wetlands is strongly influenced by precipitation and evapotranspiration; thus, their hydrographs may be highly variable. Composition of the bay vegetation is determined primarily by topographic relief and the hydrology of individual bays. The vegetation may be predominantly herbaceous species, with conspicuous patterns of zonation from floating leaved aquatic plants such as water lily (*Nymphaea odorata*) in deeper areas, to emergent grasses such as maidencane (*Panicum hemitomun*) to a rim of shrubs like buttonbush (*Cephalanthus occi-*



dentalis), red bay *(Persea borbonia)*, and sweet bay (*Magnolia virginiana*). Other Carolina bays may be forested, often with tupelo (*Nyssa sylvatica and N. biflora*), red maple, and occasionally cypress. These wetlands harbor a large proportion of the southeastern region's rare species (Edwards and Weakley 2001) and are critical habitats for birds, mammals, amphibians, and reptiles (Sharitz and Gibbons 1982).

Throughout the southeast, most Carolina bays have been altered, or even completely destroyed, by ditching and draining, conversion to agriculture, or even industrial or urban development. In South Carolina, 95% of the remaining bays show evidence of moderate to severe disturbance (Bennett and Nelson 1991).

Approximately 400 Carolina bays (or bay-like depressions) have been identified on the SRS, ranging from aquatic ponds to herbaceous meadows to forested savannas. Many of the smaller bays were ditched and drained by the original landowners before the site was acquired (Kirkman et al. 1996), and today these small drained bays no longer support viable populations and communities of wetland organisms. The USFS-SR and SREL have recently undertaken a research program to restore 16 of these bays. Restoration actions include closing drainage ditches, removing non-wetland trees from the bay interiors, and planting wetland tree and grass species. Planned endpoints of the restoration include forested savanna bays with cypress and tupelo trees, and herbaceous meadow bays with wetland grasses such as leersia (*Leersia hexandra*) and maidencane. Bay rims will be managed either as pine savannas that are burned frequently or as pine hardwood communities. The protection and restoration of Carolina bays on the SRS is critically important to maintaining this regional wetland type and the unique biota they contain. This is an excellent example of the value of federal lands as a repository and restoration site for threatened habitats.



Ecosystem Integrity of the SRS

Despite past land uses and current industrial activities on the site, the SRS today is one of the most biologically diverse areas in the Southeast. Seventy-nine species of freshwater fish live in SRS wetlands, and virtually all of the more than 50 mammal species native to the upper Coastal Plain are found on the site. The SRS is home to 42 species of amphibians and 59 species of reptiles, more than have been recorded from any other publicly owned land area in the U.S. About 174 bird species are found, including the federally endangered wood stork

(*Mycteria americana*) which forages in wetlands on the SRS. Over 1,500 species of vascular plants have been collected on the SRS, including the federally endangered smooth purple coneflower (*Echinacea laevigata*). The high ecological integrity of the SRS is promoted by site management and could serve as a model for management of other federal lands in the region.

Ecosystem integrity is the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats of the region (Angermeier and Karr 1994). Why is ecosystem integrity so important? Very simply, because sustaining ecosystem integrity is the best way to protect biodiversity, ensure sustainable use, and minimize the effort and cost of management. Thus, a goal of SRS management is to "characterize, evaluate, restore, and sustain the health, productivity, and diversity of natural resources" (USFS-SRS 2000).

The SRS as a Source of Information and Technology

The SRS has a legacy of 50 years of extensive research on ecosystems of the fall line region. Research has focused on understanding effects of disturbances within the southeastern Coastal Plain ecosystem, especially those resulting from land management practices, from on-site industrial activities, and from nearby urban and industrial development. The results from these studies have been used in ecosystem management of the SRS, and this knowledge and technology are directly transferable to the management of other federal lands within the region.

Since there are extensive federal land holdings along the southeastern fall line, DoD and DOE have an important role to play in the future of this area. The future of the fall line region needs to be considered within the broader context of the whole southeastern US. The "Sun Belt" of the Southeast is under increased pressure for intense agricultural land use and urban and industrial development. Much of this development expansion will likely occur in more fertile areas of the central and outer Coastal Plain, leaving the fall line sandhills, with their unique biota and low fertility soils, as important sites to achieve national and regional conservation goals, such as preserving and enhancing endangered species habitats. It is not inconceivable that partnerships among federal lands in the fall line region could lead to their becoming islands of diversity within the Southeast.

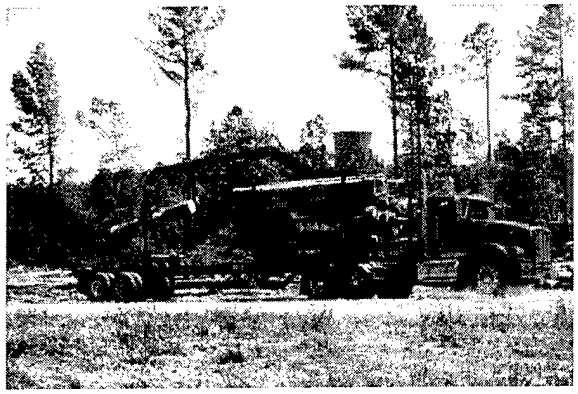
The SRS can contribute:

A legacy of research on understanding effects of disturbances and land management practices within the southeastern Coastal Plain ecosystem, including long-term studies of species populations and ecological processes.

Extensive knowledge of ecosystem management of federal lands that is transferable to other sites. SREL has published more than 2500 research papers since 1950, and trained more than 270 graduate students in ecological principles.

A base for communication to share available information and work to adopt an ecosystem approach, drawing upon knowledge and experience in land management from sites within the region and providing a forum for discussion among regional partners.

The ***Partners Along the Fall Line Sandhills Ecology and Ecosystem Management Workshop*** was held to explore ways to extend benefits from the research and monitoring activities underway through the SEMP program at Ft. Benning, and elsewhere in the sandhills region, to other managed lands (both DoD and non-DoD) that share ecoregional attributes. Because of its comparable ecosystem management goals and land use practices, the SRS is potentially a strong ecoregional partner. In addition, through its distance learning facility, SREL can serve as a base for communication, and can establish an information exchange program to develop the concept of ecosystem management as applied to federal lands in the Southeast. The potential role of the SRS in achieving the SERDP SEMP goal of understanding and applying concepts of ecosystem management to lands in the fall line region should be explored more fully.



Literature Cited

Angermeier, P. L. and J. R. Karr, 1994. Biological integrity versus biological diversity as policy directives. BioScience 44 (10) 690-697.

Barton, C., E. A. Nelson, R. K. Kolka, K. W. McLeod, W. H. Conner, M. Lakly, D. Martin, J. Wigginton, C. C. Trettin, and J. Wisniewski. 2000. Restoration of a severely impacted riparian wetland system – The Pen Branch Project. Ecological Engineering 15:S3-S15.

Bennett, S. H. and J. B. Nelson. 1991. *Distribution and Status of Carolina Bays in South Carolina*. Heritage Trust Publication No. 1, SC Wildlife and Marine Resources Department, Columbia, SC.

Collins, B., R. Sharitz, J. McArthur, C. Romanek, J. Seaman, P. White, and M. Cadenasso. 1999. Thresholds of disturbance: Land management effects on vegetation and nitrogen dynamics. Proposal to Strategic Environmental Research and Development Program, SEMP (CSSON-00-03).

Edwards, A. L. and A. S. Wealkey. 2001. Population biology and management of rare plants in depression wetlands of the southeastern Coastal Plain, USA. Natural Areas Journal 21:12-35.

Gibbons, J. W. and R. R. Sharitz. 1981. Thermal ecology: Environmental teachings of a nuclear reactor site. BioScience 30:293-298.

Jones, R. H. and R. R. Sharitz. 1998. Survival and growth of woody plant seedlings in floodplain forest understories, South Carolina. Journal of Ecology 86:574-587.

Jones, R. H., R. R. Sharitz, S. M. James, and P. M. Dixon. 1995. Tree population dynamics in seven South Carolina mixed-species forests. Bulletin of the Torrey Botanical club 121:360-169.

Kirkman, L. K., R. F. Lide, G. R. Wein, and R. R. Sharitz. 1996. Vegetation changes and land-use legacies of depression wetlands of the western Coastal Plain of South Carolina 1951-1992. Wetlands 16:564-576.

Kovacic, D. A., T. G. Ciravolo, K. W. McLeod, and J. S. Erwin. 1990. Potential nitrate leaching losses and nitrogen mineralization in an Atlantic Coastal Plain watershed following disturbance. In: *Ecological Processes and Cumulative Impacts*. J. G. Gosselink, L. C. Lee and T. A. Muir (eds.). Lewis Publ., Inc. pp. 103-122.

Kreher, S. A., S. A. Foro, and B. S. Collins. 2000. Genetic variation within and among patches of the clonal species, *Vaccinium stamineum* L. Molecular Ecology 9:1247-1252.

McLeod, K. W. 2000. Species selection trials and silvicultural techniques for the restoration of bottomland hardwood forests. Ecological Engineering 15:S35-S46.

Sharitz, R. R. and., J. W. Gibbons. 1982. The ecology of southeastern shrub bogs (pocosins) and Carolina bays: a community profile. FWS/OBS-82/04. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service, Division of Biological Services. 93 p

Sharitz, R. R., J. E. Irwin and E. J. Christy, 1974. Vegetation of swamps receiving reactor effluents. Oikos 25: 7-13.

Sharitz, R. R., R. L. Schneider, and L. C. Lee. 1990. Composition and regeneration of a disturbed river floodplain forest in South Carolina. In: *Ecological Processes and Cumulative Impacts*. J. G. Gosselink, L. C. Lee, and T. A. Muir (eds.). Lewis Publ., Inc. pp. 195-218.

Skorupa, J.P. and R.W. McFarlane. 1976. Seasonal variation in foraging territory of red-cockaded woodpeckers. The Wilson Bulletin 88:662 665.

Stangel, P. W. 1990. Genetic variation and population structure of the red-cockaded woodpecker. Ph.D. dissertation, University of Georgia, Athens, GA.

USFS-SR. 2000. U.S. Forest Service – Savannah River Web Page. http://www.srs.gov/general/srenviro/srfs

Workman, S. W. and K. W. McLeod. 1990. *Vegetaton of the Savannah River Site: Major Community Types*. SRO-NERP-19. Savannah River Ecology Laboratory, Aiken, SC.

Origin and Goals of SEMP—DoD Perspective

PRESENTER: Bill Goran for Bradley Smith

ABSTRACT*: DoD in general supports the concept of Ecosystem wide land management. This is stated clearly in a series of policy statements at both DoD and Service level. In the research area, this is being supported by the SERDP SEMP effort though a broad based partnership of research, public and academic organizations. These groups have begun to identify the requirements, establish a long term ecosystem monitoring program, conduct research, integrate the findings into DoD management practices. DoD stays actively involved in this work through a Technical Advisory Committee (TAC). The Program Manager works with the TAC and the SERDP Program Office to develop statements of need (SONs) for research efforts. These SONs are then handled like other SERDP SONs, with solicitations made through the SERDP website (http://www.serdp.org/) and other mechanisms. Responses are then sent out for a scientific peer review. The SEMP TAC performs the second level of review, and makes recommendations for funding to the SERDP Executive Director and Scientific Advisory Board.

*This section largely from *The SEMP Approach: Plans and Progress of the Strategic Environmental Research and Development Program (SERDP) Ecosystem Management Project (SEMP)*, William D. Goran, Teresa Aden, Harold E. Balbach, Beverly Collins, Virginia Dale, Theresa Davo, Patrick J. Guertin, John Hall, Rose Kress, David Price, Pete Swiderek, ERDC SR-02-1, March 2002.

PRESENTATION: Origin and Goals of SEMP—DoD Perspective

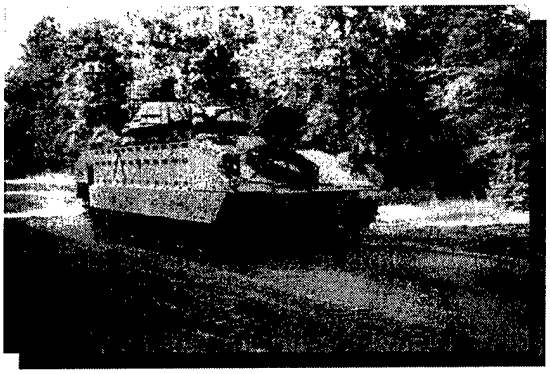
Origin and Goals of SEMP—DoD Perspective *

Military Conservation Policy

The DoD has, in the 1990s, developed a wide range of policy guidance. Two examples will serve to illustrate this trend.

DoD Policy

A. DoD Instruction 4715.3, Environmental Conservation Program, 03 May 1996



This Instruction implements policy, assigns responsibilities, and prescribes procedures for integrated management of natural and cultural resources on property under DoD control. The DoD Instruction (DoDI) also establishes the DoD Conservation Committee that reports to the Environmental Safety and Occupational Health (ESOH) Policy Board. A few important policy statements for natural resource management include:

1) Natural resources under the stewardship and control of DoD shall be managed to support and be consistent with the military mission, while protecting and enhancing those resources for multiple use, sustainable yield, and biological integrity.

2) Integrated natural resource management plans (INRMPs) shall incorporate principles of ecosystem management. INRMPs shall be prepared, maintained, and implemented for all lands and waters under DoD control that have suitable habitat for conserving and managing natural ecosystems.

* This section largely from *The SEMP Approach: Plans and Progress of the Strategic Environmental Research and Development Program (SERDP) Ecosystem Management Project (SEMP)*, William D. Goran, Teresa Aden, Harold E. Balbach, Beverly Collins, Virginia Dale, Theresa Davo, Patrick J. Guertin, John Hall, Rose Kress, David Price, Pete Swiderek, ERDC SR-02-1, March 2002.

3) Sensitive natural resources or species shall be inventoried and managed to protect these resources, and to promote biodiversity.

4) DoD lands shall be managed for the goal of no net loss of wetlands. The development of mitigation "banks" is encouraged as sound conservation planning.

B. DUSD(ES) Memo "Implementation of Ecosystem Management in the DoD," 08 Aug 1994

The goal of the memo from the Deputy Under Secretary of Defense (Environmental Security) is to maintain and improve the sustainability and native biological diversity of terrestrial and aquatic, including marine, ecosystems while supporting human needs, including the DoD mission. "Ecosystem management" is defined to include:

1) Ecological approach - The DoD will continue to shift its focus from protection of individual species to management of ecosystems.

2) Partnerships - The DoD will form partnerships to achieve shared goals. Ecosystems cross political boundaries, making the need for cooperation, coordination, and partnerships essential for managing ecosystems.

3) Participation - Public involvement, communication, and incorporation of public needs and desires into management decisions will be emphasized.

4) Information - The best available scientific and field- tested information will be used in making decisions and selecting the most appropriate technologies in management of natural resources.

5) Adaptive management - Resource mangers will incrementally implement adaptive management techniques.

According to the above memo, on DoD installations, ecosystem management is supposed to be achieved by developing and implementing integrated natural resources management plans and ensuring they remain current. Ecosystem management is already being implemented at some installations and these efforts are being expanded by DUSD participation in the Interagency Ecosystem Management task force. The task force's activities include regional ecosystem management initiatives (e.g., Mojave desert) with DoD as a lead in partnership with the Department of Interior.

Similar policy documents exist for each Service. Briefly:

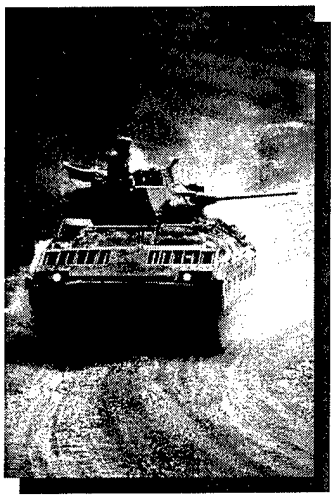
Army Policy

A. DASA(ESOH) Memo "Conservation Policy," 08 Jul 1995

The Deputy Assistant of Secretary of the Army for Environment, Safety and Occupational Health established three new conservation goals for the management of the Army's training and testing lands

B. Army Regulation (AR) 200-1, Environmental Protection and Enhancement, 23 Apr 1990

This regulation prescribes Department of the Army (DA) responsibilities, policies, and procedures to preserve, protect, and restore the quality of the environment.



C. AR 200-2, Environmental Effects of Army Actions, 23 Dec 1988

This regulation establishes policy, procedures, and responsibilities for integrating environmental considerations into Army planning and decision-making and assessing the environmental effects of Army actions.

D. AR 200-3, Natural Resources - Land, Forest and Wildlife Management, 28 Feb 1995

This regulation prescribes current Army policies, procedures, and standards for the conservation, management, and restoration of land and the renewable natural resources thereon consistent with and in support of military mission and in consonance with national policies. The scope includes the conservation, management, and utilization of the soils, vegetation, water resources, croplands, rangelands, forests, and fish and wildlife species.

Navy Policy

A. ASN (I&E) Memo, "Department of the Navy Natural Resources Strategic Plan," 11 Jul 1994

Office of the Chief of Naval Operations (CNO) established a central guide for natural resources management policy in the Department of the Navy. Each installation was encouraged to adopt the plan's three strategic pillars in its environmental management policy by emphasizing stewardship of natural resources, preserving biological diversity and developing partnerships for conservation.

B. Office of the Chief of Naval Operations Instruction (OPNAVINST) 5090.1B, Navy Environmental and Natural Resources Program Manual, 1 Nov 1994

The CNO has defined the Navy's environmental vision to be "Navy recognized as an environmental leader while effectively executing naval operations." Thus, an

important part of the Navy's mission was identified as pollution prevention, protection of the environment, and protection of natural, historic, and cultural resources.

Air Force Policy

A. Air Force Policy Directive (AFPD) 32-70, Environmental Quality, 20 Jul 1994

This directive establishes that The Assistant Secretary of the Air Force for Manpower, Reserve Affairs, Installations and Environment (SAF/MI) is responsible for environmental protection policy matters. Achieving and maintaining environmental quality is an essential part of the Air Force mission.

B. Air Force Instruction (AFI) 32-7061, The Environmental Impact Analysis Process, 24 Jan 1995

This AFI implements AFPD 32-70. This instruction provides procedures that are essential to achieve and maintain compliance with NEPA and CEQ regulations for implementing procedural provisions of NEPA (40 CFR 1500-1508).

C. AFI 32-7064, Integrated Natural Resources Management, 1 Aug 1997

This AFI explains how to manage natural resources on Air Force property in compliance with Federal, state, and local standards.

SERDP Ecosystem Management Project (SEMP)

As we may see from the above review of the policy documents of each service and from the DoD, itself, furtherance of the knowledge and skills required to actually characterize and manage the ecosystem is explicitly or implicitly requested by each department. Further, the actions of SERDP in promoting such ecosystem-based research are clearly consonant with the SERDP charter and goals. There can be no question but that the DoD is committed to proactive ecosystem management of military lands and waterways. Installations in all of the services conduct active and often award winning ecosystem management programs, supporting both the sustainable mission use of military lands and stewardship of the valuable ecological resources on these lands. Guidance was developed for DoD installations to pursue ecosystem management principles. A report was published, in collaboration with The Nature Conservancy, to provide background and guidance for DoD ecosystem managers* (Leslie, 1996).

* Leslie M., G.K. Meffe, J.L. Hardesty, D.L. Adams. 1996. *Conserving Biodiversity on Military Lands: A Handbook for Natural Resources Managers.* Arlington, VA: The Nature Conservancy.

All of the DoD services have expressed (in formal research requirements and through other mechanisms) the need for better understanding of ecological processes and trends on military lands in relation to their surrounding lands, and the interactions between mission activities and ecological processes. In response to these expressed needs, the Strategic Environmental Research and Development Program (SERDP) held a workshop, in June 1997, entitled Management-Scale Ecosystem Research. The Workshop identified some of the critical knowledge gaps in understanding ecosystem status, especially as they relate to military land management concerns. The primary themes that emerged from the workshop included:

- ecosystem health or change indicators;
- thresholds of disturbance;
- biogeochemical cycles and processes; and
- ecosystem processes as they relate to multiple temporal and spatial scales.

After this workshop, SEMP was created as a new SERDP project to pursue ecosystem research relevant to DoD ecosystem management concerns, including the research themes from the 1997 SERDP Workshop.

DoD Conservation Objectives

The overall program objective for SEMP is to plan, coordinate, execute and manage, on behalf of SERDP, an ecosystem management project initiative that focuses on ecosystem science relevant to DoD ecosystem management concerns. This includes:

- addressing DoD requirements and opportunities in ecosystem research, as identified by the 1997 SERDP Ecosystem Science Workshop;
- establishing and managing one (or more) long-term ecosystem monitoring sites on DoD facilities for DoD relevant ecosystems research;
- conducting multiple ecosystem research and monitoring efforts, relevant to DoD requirements and opportunities, at these and/or additional facilities; and
- facilitating the integration of results and findings of research into DoD ecosystem management practices.

DoD in the SEMP Research Organization

SEMP is organized with a Program Manager, a Technical Advisory Committee (TAC), an Ecosystem Characterization and Monitoring Team, Host Site(s) Points of Contact, and Research Teams. The Program Manager works with the TAC and the SERDP Program Office to develop statements of need (SONs) for research efforts. These SONs are then handled like other SERDP SONs, with solicitations made through the SERDP website (http://www.serdp.org) and other mechanisms. Responses are then sent out for a scientific peer review. The SEMP TAC performs the second level of review, and makes recommendations for funding to the SERDP Executive Director and Scientific Advisory Board. The figure below reflects the roles and functions of all participants within the SEMP project. DoD participation is generally with the groups aligned on the upper half of the chart.

The Ecosystem Characterization and Monitoring Initiative (ECMI) Team is led by researchers from the U.S. Army Corps of Engineers Engineer Research and Development Center (ERDC) Environmental Laboratory (EL). This team works with the host installation to gather, assess and document historic and current ecological data sources and monitoring efforts. In addition, this team is responsible for long term ecosystem monitoring. Data from the characterization effort, the monitoring efforts and the research teams all flows into the common data repository, shared by all teams and the installation managers.

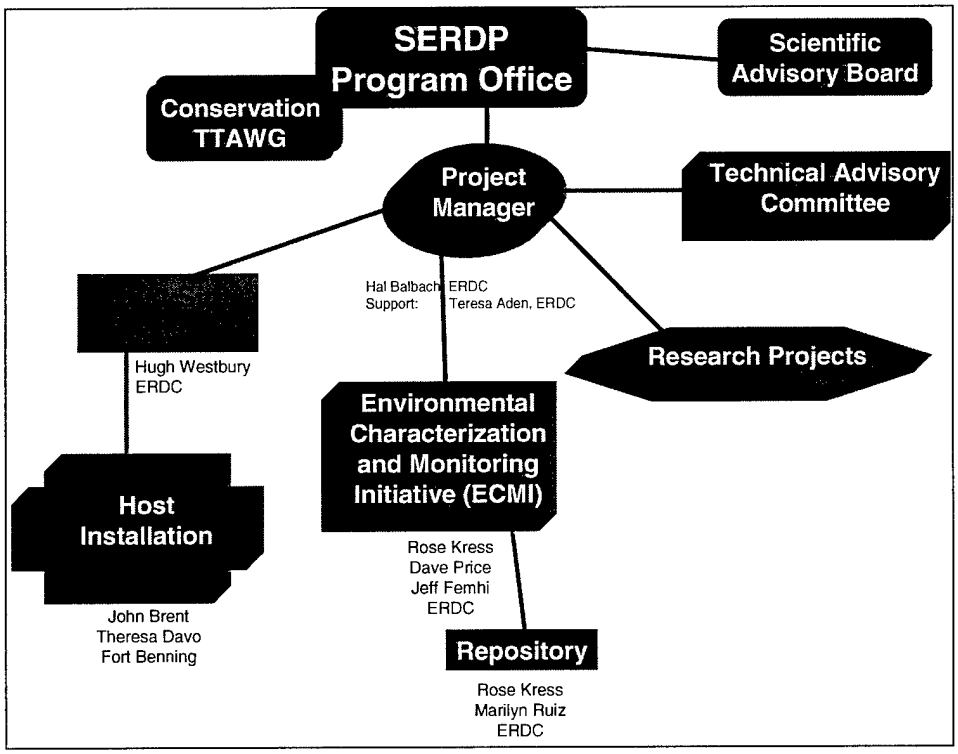


Figure 6. SEMP organizational chart.

Origin and Goals of SEMP—Research Perspective

PRESENTER: Virginia Dale

ABSTRACT:

In 1997 a workshop was sponsored by SERDP to focus on ecosystem research. It was held at Airle House in Virginia and included 18 participants and more than 30 advisors and observers. The workshop was coordinated by Dan Botkin, Patrick Megonigal and Neil Sampson.

There were four working hypotheses for the workshop:

- It is possible to do ecosystem scale research on military lands while operations are ongoing.
- Such research would be supportive of specific military missions and overall mission readiness.
- This research would advance ecosystem science and be of interest to the ecological scientific community.
- This research would improve the management of the ecosystems on DoD lands and waters, including:
  - Conservation of biological resources
  - Compliance with environmental laws and regulations
  - Restoration of disturbed areas.

There are several existing features of DoD lands that support these hypotheses:

- DoD lands and waters include many unique ecosystems
- In-place ecological research demonstrates that military mission activities and ecological research can proceed together
- Requirements for mission readiness provide ecosystem research opportunities
- Many pieces already in place:
  - DoD experience in natural resource management
  - Ecological research conducted by "outside" organizations
- DoD advanced technologies can improve ecosystem management and research
- DoD provides opportunities to conduct statistically valid ecosystem-level experiments

The goal of ecosystem management on DoD lands is timely. Adaptive management is key to ecosystem management. Major advances have occurred in ecosystem research, but opportunities to apply or test these ideas have been rare.

The four primary themes of ecosystem management that came out of the 1997 workshop are ecological indicators, thresholds of disturbance, biogeochemical cycles and processes, and ecosystem processes as they re-

late to multiple temporal and spatial scales. Ecological indicators entails two key questions:

- How do you determine the two kinds of indicators?
  - _ Measures of ecosystem status
  - _ Measures of change in status
- Are there indicators that take advantage of new technologies?

Thresholds of disturbance contains five questions:

- How does that way a system responds to a disturbance affects its sustainability?
- What is the appropriate way to characterize the natural disturbance history of a site (its historical range of variability)?
- How do natural and anthropogenic disturbances interact?
- When do thresholds occur?
- How do you define thresholds for ecological processes?

Biogeochemical cycles and processes involves three issues:

- What chemical elements limit and/or control production and diversity, and under what conditions?
- When does total biomass and/or biological diversity affect chemical cycling, including storage and loss of specific chemical elements?
- Is the simultaneous sustainability of biological diversity and biogeochemical cycles possible?

Ecosystem processes at multiple temporal and spatial scales revolves around five concerns:

- How does the scale of the disturbance affect management decisions?
- Does maintenance of diversity depend on spatial scale, pattern and form?
- How do ecological processes interact at different scales?
- Can we "scale up" information about ecological processes?
- How do you measure ecological processes at different scales?

Resolving these questions is the basis of the SERDP Ecosystem Management Project (SEMP).

PRESENTATION: Origin and Goals of SEMP—Research Perspective

SERDP ornl

Overview of 1997 Workshop on Management-Scale Ecosystem Research

Virginia H. Dale
Environmental Sciences Division
Oak Ridge National Laboratory

SERDP ornl

1997 Workshop

- Sponsored by SERDP
- Held at Airle House, Virginia
- June 2-5, 1997
- 18 participants
- >30 advisors and observers
- Coordinated by Dan Botkin, Patrick Megonigal and Neil Sampson

SERDP ornl

Working Hypotheses

- It is possible to do ecosystem scale research on military lands while operations are ongoing
- Such research would be supportive of specific military missions and overall mission readiness
- This research would advance ecosystem science and be of interest to the ecological scientific community
- This research would improve the management of the ecosystems on DoD lands and waters, including
  - Conservation of biological resources
  - Compliance with environmental laws and regulations
  - Restoration of disturbed areas

SERDP ornl

Support for Hypotheses

- DoD lands and waters include many unique ecosystems
- In-place ecological research demonstrates that military mission activities and ecological research can proceed together
- Requirements for mission readiness provide ecosystem research opportunities
- Many pieces already in place
  - DoD experience in natural resource management
  - Ecological research conducted by "outside" organizations
- DoD advanced technologies can improve ecosystem management and research
- DoD provides opportunities to conduct statistically valid ecosystem-level experiments

SERDP ornl

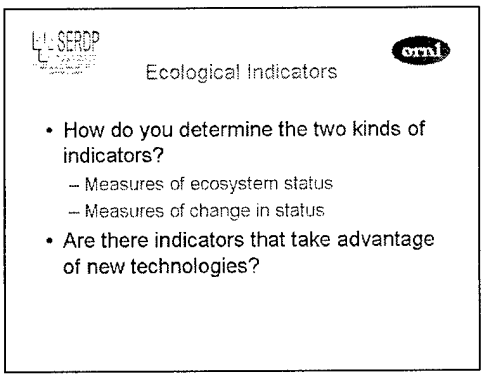
Goal of Ecosystem Management on DoD Lands is Timely

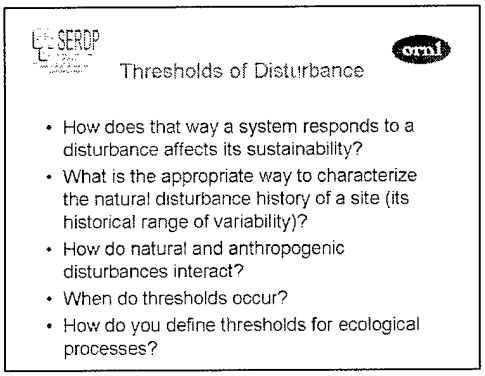
- Adaptive management is key to ecosystem management
- Major advances have occurred in ecosystem research, but opportunities to apply or test these ideas have been rare

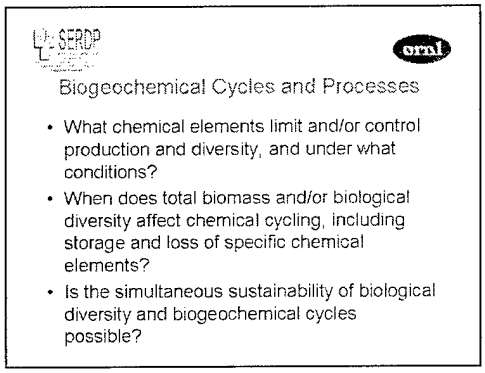
SERDP ornl

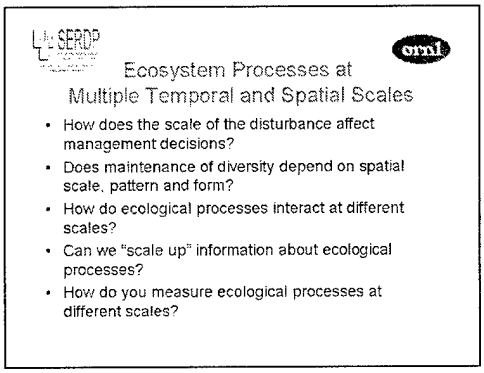
Primary Themes

- Ecological indicators
- Thresholds of disturbance
- Biogeochemical cycles and processes
- Ecosystem processes as they relate to multiple temporal and spatial scales.









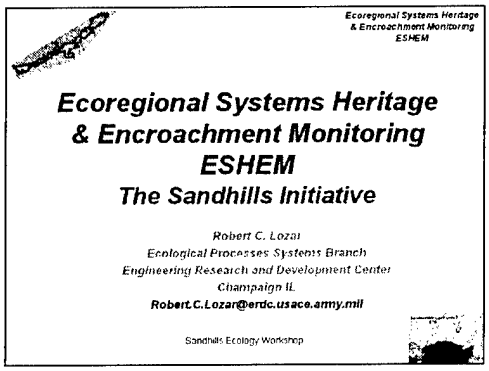
Ecoregional Systems Heritage and Encroachment Monitoring (ESHEM): The Sandhills Initiative

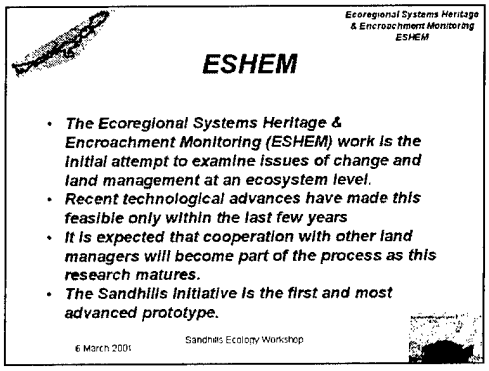
PRESENTER: Bob Lozar

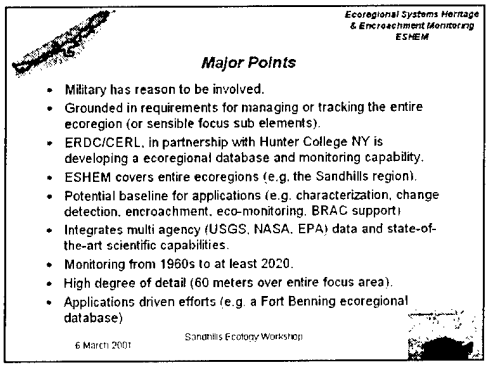
ABSTRACT: The Ecoregional Systems Heritage & Encroachment Monitoring (ESHEM) work is the initial attempt to examine issues of change, sustainment and land management at an ecosystem level. Recent technological advances have made this feasible only within the past few years. ERDC/CERL in cooperation with Hunter College NY are developing an ecoregional database and monitoring configuration with the Sandhills as the first and most advanced prototype. The initiative is grounded in specific requirements for managing or tracking the entire ecoregion (or sensible sub elements). ESHEM can spatially cover an entire ecosystem and temporally for the period from the 1960s to at least 2020. Monitoring efforts are at a high degree of detail (i.e., at least 60 meter over the entire the Sandhills ecosystem) or can be extracted for subelements at a more regional level. This database can provide a baseline, against which trends/changes can be evaluated/monitored. The initiative integrates data and state of the art scientific capabilities from several agencies (USGS, NASA, EPA). It is expected that cooperation with other agency land managers will become part of

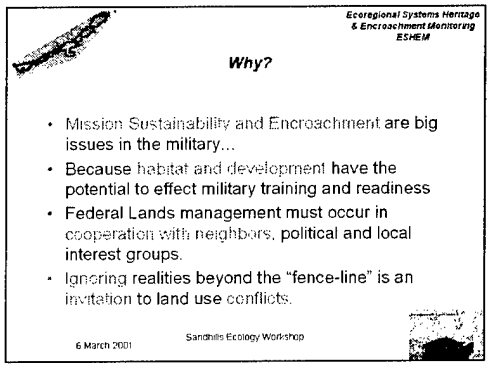
the process as this research matures. Geographical scope covers an entire ecoregion with contextual themes, source imagery and derived data. Military training and testing installations have reason to be involved because the efforts are driven by applications. Applications include Change Detection, Encroachment and Sustainability, Ecoregional health monitoring capability, and Base Realignment and Closure (BRAC).

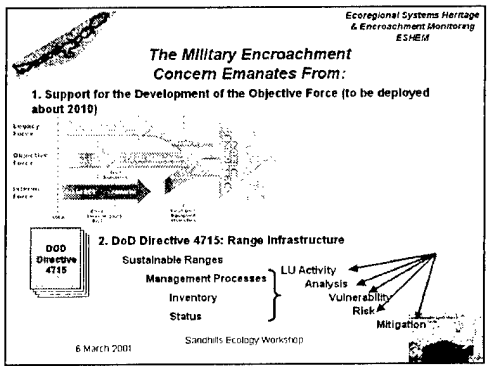
PRESENTATION: EcoRegional Systems Heritage and Encroachment Monitoring (ESHEM): The Sandhills Initiative

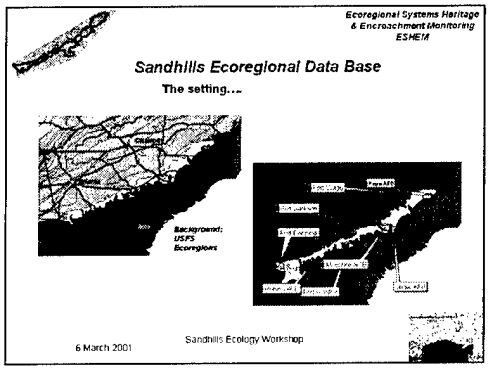












Ecoregional Systems Heritage & Encroachment Monitoring ESHEM

Sandhills Ecosystem Data Base

ERDC/CERL, in cooperation with Hunter College NY is developing a ecoregional database

Several contextual themes are being implemented:

Watersheds

Rivers

Topography

Population

Precipitation

Transportation

Others...

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Sandhills Ecosystem Data Base

Historical Trend Data

The North American Land Characterization (NALC) data sets

- **Provides imagery data for the**
  - 1970s, 1980s, early 1990s,DEMs
- **Consistent Georeferenced data set**
- **Provides Objective evaluation of Land cover (therefore Landscape Ecology) trends**

The Multi-Resolution Land Characteristics (MLRC) data sets

- **Provides similar data for later 1990s**
- **Coordinates with standard Land Cover Classes (National Land Characterization Data - NLCD)**

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Example NALC Source Imagery (MSS)

Columbus GA

Based on Satellite Imagery

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Sandhills Ecosystem Derived Data

1972 - Supervised Classification of NALC Image

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Ecoregional Indices Monitoring

Ecosystem Monitoring Data

- NASA's new Terra Satellite
  - Is beginning to collect a 15-year scientific data set.
  - Intended to help scientists follow environmental changes.
- For the *Sandhill* research we are using with the MODIS Instrument.
  - Regional scale
  - Regular and frequent revisit rate.
  - Products useful for landscape ecology:
    - Land Cover/Land Cover Change
    - Vegetation Indices
    - Thermal change
    - Leaf Area Index
    - Photosynthetically Active Radiation
    - Evapotranspiration
    - Net Primary Productivity
    - Gridded Vegetation Indices
    - Vegetation Cover Conversion

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Ecoregional Indices Monitoring

Ecosystem Future Monitoring Data

- Just released – the very First MODIS Reflectance data for the Southeast.
- MODIS Image example integrated with ATtILA indices data base.

Sand Hills

June 8 2000 Image

June 1 2000 Image

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Sandhills Ecosystem Data Base

Potential Partnering

Other Federal Lands (yellow) within Ecosystem and within Study Region

Federal Agencies represented are:

- Forest Service
- Fish & Wildlife Service
- National Parks Service
- DoD

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Ecoregional Systems Heritage & Encroachment Monitoring ESHEM

Applications

- **Change Detection**
- **Encroachment Detection & Sustainability**
- **Ecoregional Health Monitoring**
- **Regional Characterizations**
- **Base Realignment and Closure (BRAC)**

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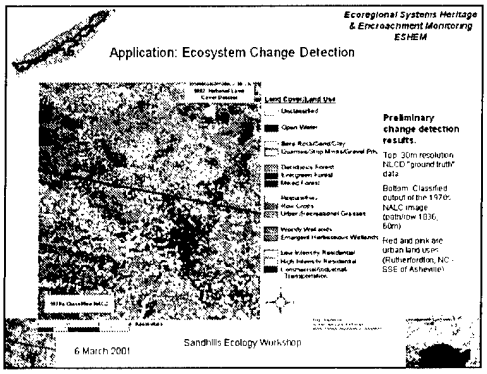
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecosystem Change Detection
Preliminary change detection results.
Top: 30m resolution NLCD "ground truth" data
Bottom: Classified output of the 1970s NALC image (path/row 16/36, 60m)
Red and pink are urban land uses (Rutherfordton, NC - SSE of Asheville)
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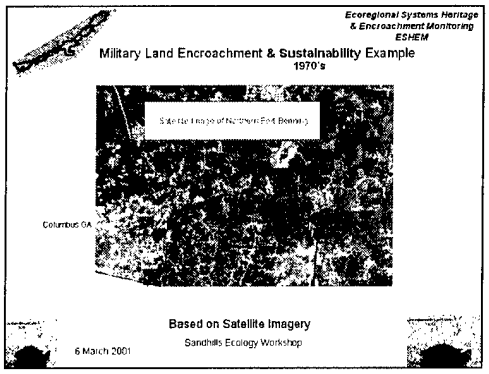
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Military Land Encroachment & Sustainability Example
1970's
Columbus GA
Based on Satellite Imagery
6 March 2001
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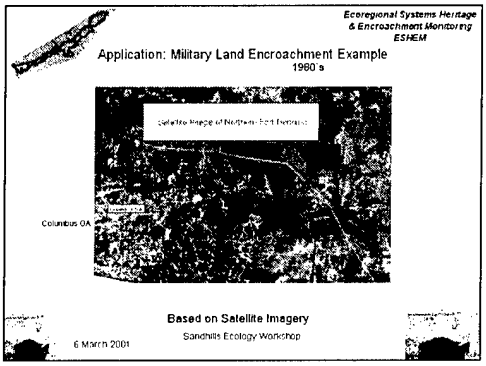
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Application: Military Land Encroachment Example
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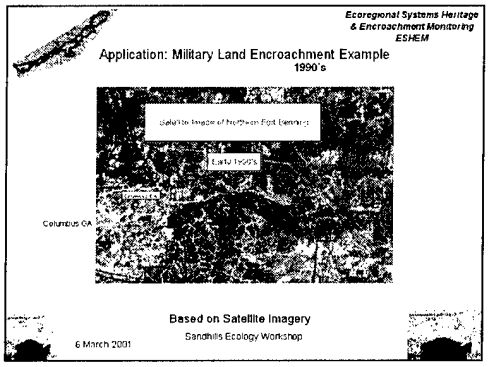
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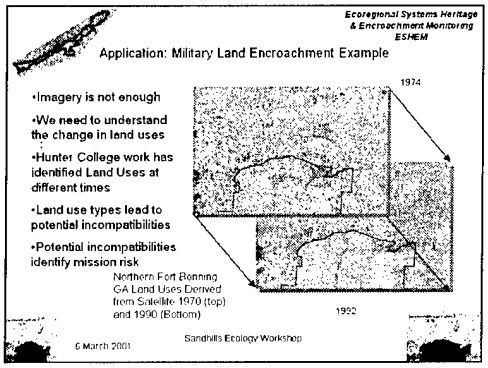
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Military Land Encroachment Example
•Imagery is not enough
•We need to understand the change in land uses
•Hunter College work has identified Land Uses at different times
•Land use types lead to potential incompatibilities
•Potential incompatibilities identify mission risk
1974
1992
Northern Fort Benning GA Land Uses Derived from Satellite 1970 (top) and 1990 (Bottom)
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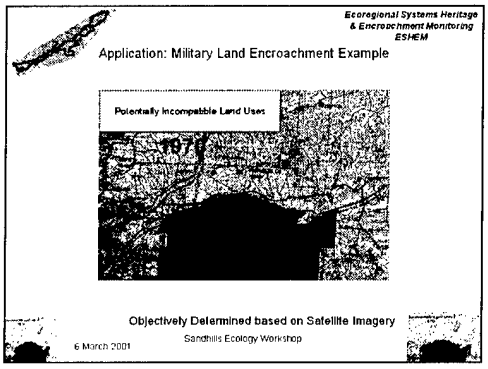
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Military Land Encroachment Example
Potentially Incompatible Land Uses
1970
Objectively Determined based on Satellite Imagery
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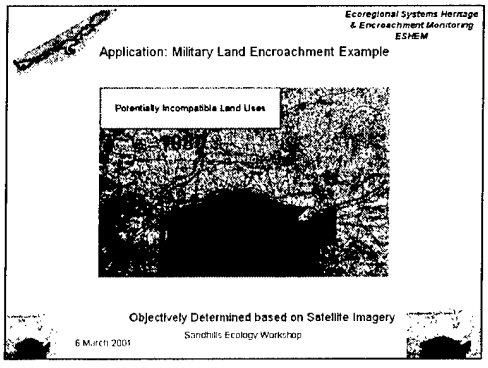
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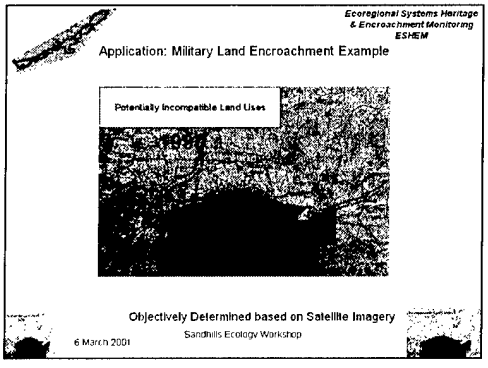
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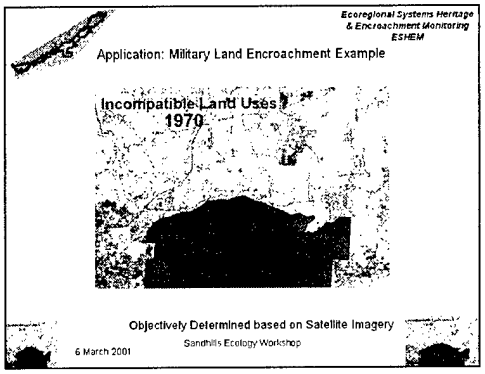
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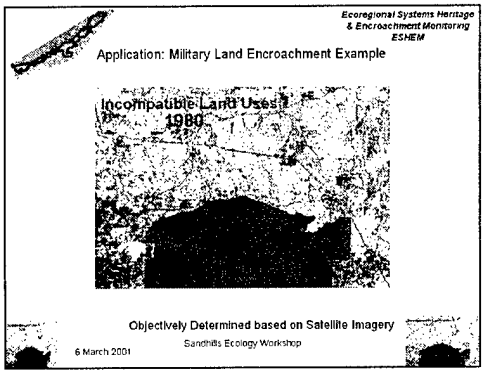
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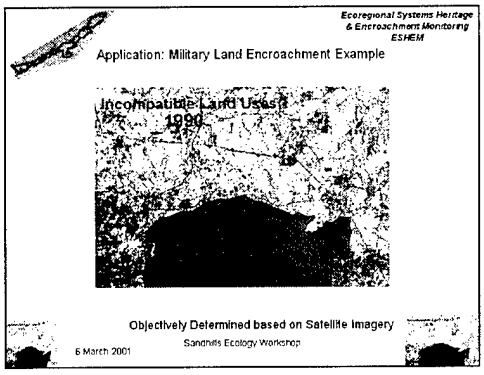
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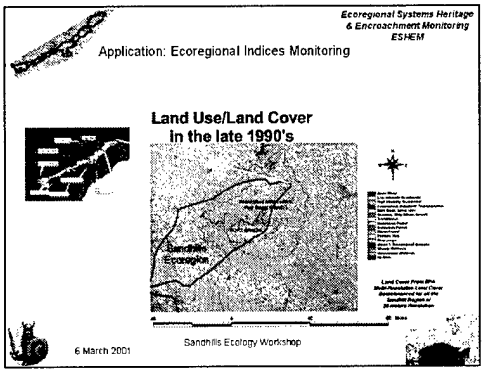
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Land Use/Land Cover in the late 1990's
Sandhills Ecoregion
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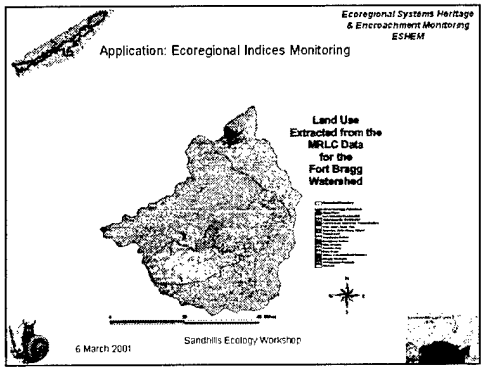
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Land Use Extracted from the MRLC Data for the Fort Bragg Watershed
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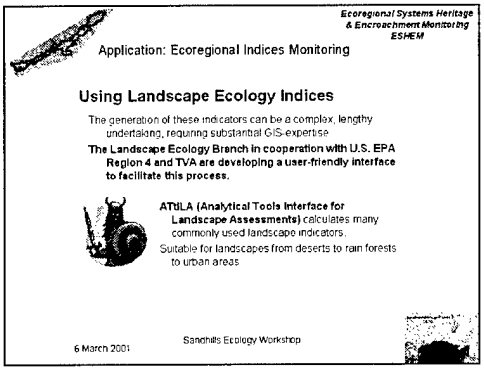
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Using Landscape Ecology Indices
The generation of these indicators can be a complex, lengthy undertaking, requiring substantial GIS-expertise
The Landscape Ecology Branch in cooperation with U.S. EPA Region 4 and TVA are developing a user-friendly interface to facilitate this process.
ATtILA (Analytical Tools Interface for Landscape Assessments) calculates many commonly used landscape indicators.
Suitable for landscapes from deserts to rain forests to urban areas
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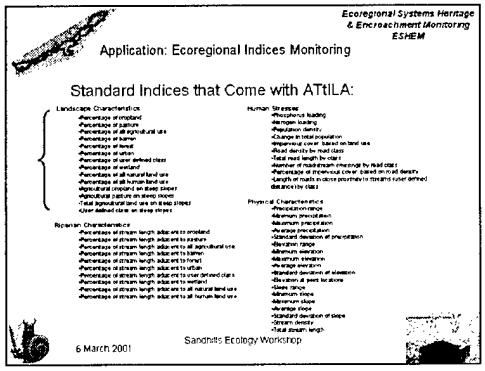
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Standard Indices that Come with ATtILA:
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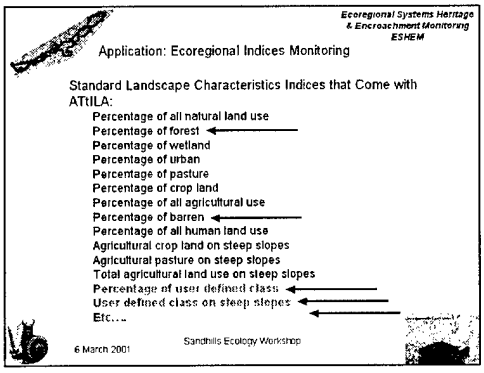
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Standard Landscape Characteristics Indices that Come with ATtILA:
Percentage of all natural land use
Percentage of forest
Percentage of wetland
Percentage of urban
Percentage of pasture
Percentage of crop land
Percentage of all agricultural use
Percentage of barren
Percentage of all human land use
Agricultural crop land on steep slopes
Agricultural pasture on steep slopes
Total agricultural land use on steep slopes
Percentage of user defined class
User defined class on steep slopes
Etc....
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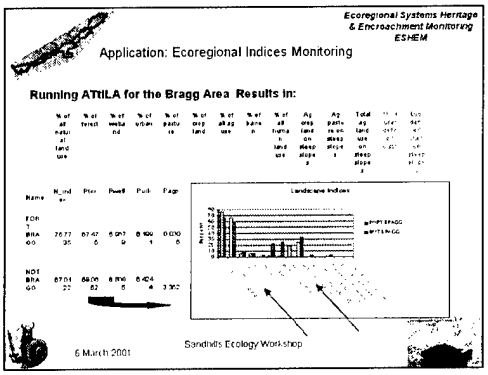
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Running ATtILA for the Bragg Area Results in:
Landscape Indices
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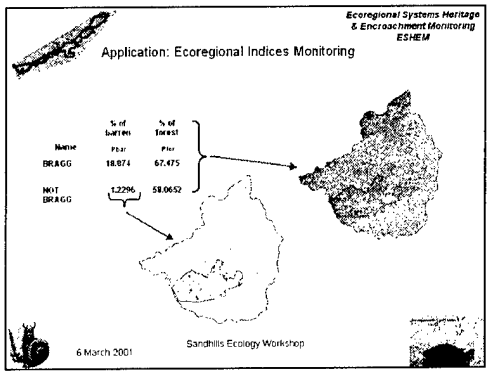
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
% of barren
% of forest
Name
Pbar
Pfor
BRAGG
18.874
67.475
NOT BRAGG
1.2296
58.0652
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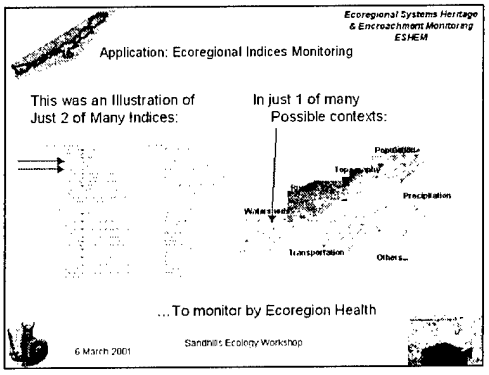
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
This was an Illustration of Just 2 of Many Indices:
In just 1 of many Possible contexts:
Population
Topography
Precipitation
Watersheds
Transportation
Others...
...To monitor by Ecoregion Health
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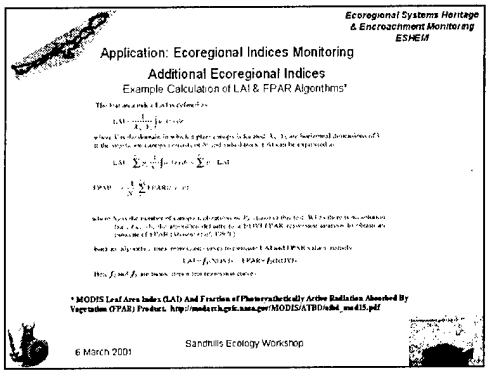
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Additional Ecoregional Indices
Example Calculation of LAI & FPAR Algorithms*
* MODIS Leaf Area Index (LAI) And Fraction of Photosynthetically Active Radiation Absorbed By Vegetation (FPAR) Product. http://modarch.gsfc.nasa.gov/MODIS/ATBD/atbd_mod15.pdf
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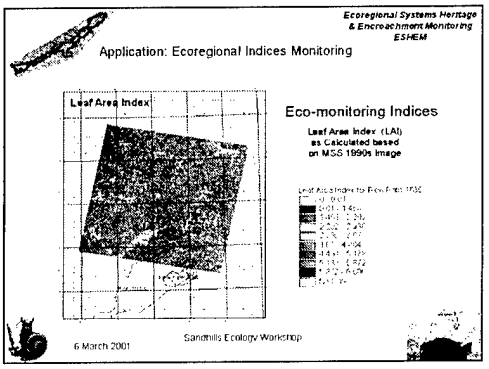
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Leaf Area Index
Eco-monitoring Indices
Leaf Area Index (LAI) as Calculated based on MSS 1990s Image
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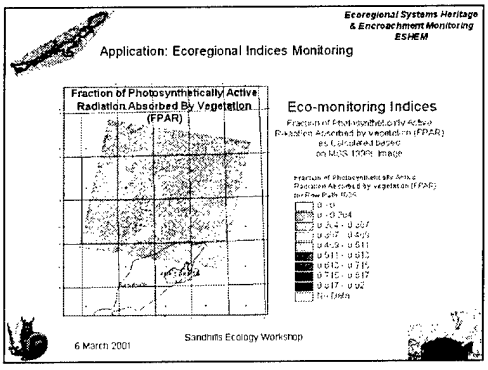
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Ecoregional Indices Monitoring
Fraction of Photosynthetically Active Radiation Absorbed By Vegetation (FPAR)
Eco-monitoring Indices
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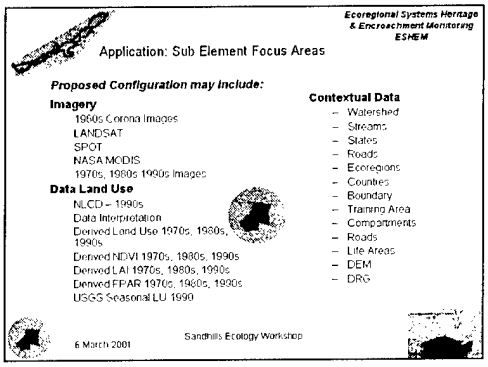
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Sub Element Focus Areas
Proposed Configuration may include:
Imagery
1960s Corona Images
LANDSAT
SPOT
NASA MODIS
1970s, 1980s 1990s Images
Data Land Use
NLCD – 1990s
Data Interpretation
Derived Land Use 1970s, 1980s, 1990s
Derived NDVI 1970s, 1980s, 1990s
Derived LAI 1970s, 1980s, 1990s
Derived FPAR 1970s, 1980s, 1990s
USGS Seasonal LU 1990
Contextual Data
– Watershed
– Streams
– States
– Roads
– Ecoregions
– Counties
– Boundary
– Training Area
– Compartments
– Roads
– Life Areas
– DEM
– DRG
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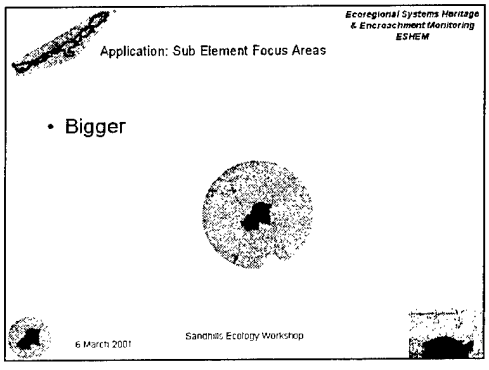
Ecoregional Systems Heritage & Encroachment Monitoring ESHEM
Application: Sub Element Focus Areas
• Bigger
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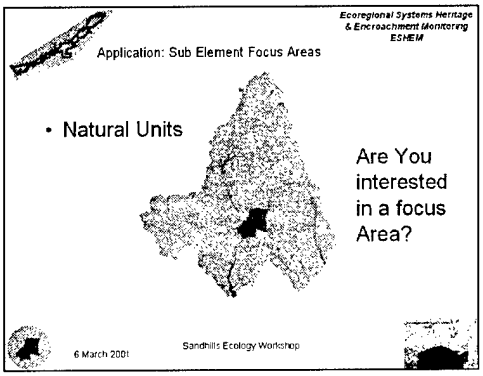
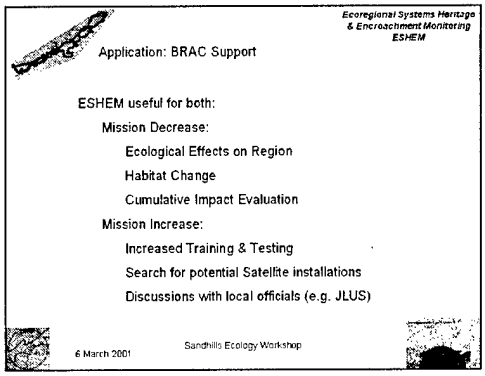
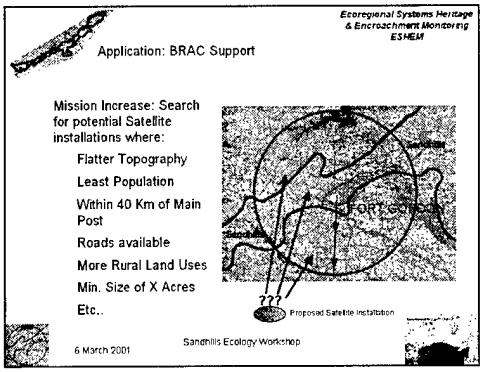
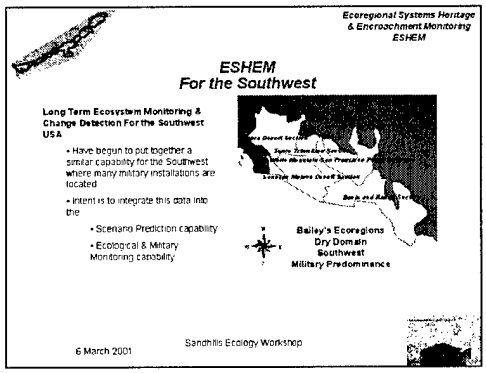
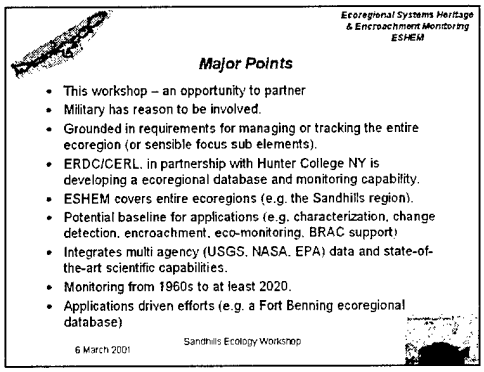










The Southern Appalachian Assessment

PRESENTER: Charles VanSickle

ABSTRACT: Large scale assessments are an essential building block for ecosystem management. The Southern Appalachian Assessment (SAA) encompassed more than 37 million acres and involved 14 federal and state agencies. Coordinated through the auspices of the Southern Appalachian Man and Biosphere program, the SAA design relied heavily on public involvement and consensus building. Public meetings were used to identify regional issues. The issues were

translated into questions that were organized into four themes--Atmospheric, Terrestrial, Aquatic, and Social/Cultural/Economic. Emphasis was placed on using existing and readily available data but each technical team was also asked to identify important data gaps or limitations. Emphasis was also placed on the development of GIS data which could be used for integrated analysis and land use planning.

The SAA has been used in many ways. It is the basis for coordinated forest plan revision on five of the Southern Appalachian National Forests. It has been used by several non-governmental organizations for project formulation and by educational organizations for class study. Communities within the region have been encouraged to use the SAA data base for community planning and for developing indicators of community health and sustainability.

PRESENTATION: The Southern Appalachian Assessment (further material available at http://samba.org/)

Cooperative Efforts of the Southeastern Natural Resource Leaders Group Using the Southeastern Ecological Framework

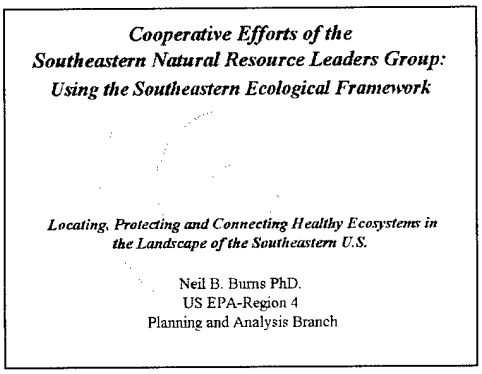
PRESENTER: Neil Burns

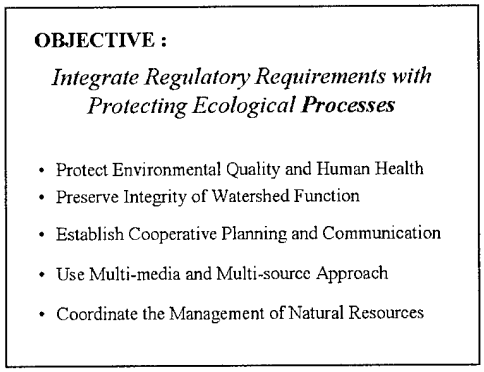
ABSTRACT: Natural ecosystems support processes that provide habitat for many species while protecting the quality of air and water for a rapidly growing human population. The southeastern U.S. has unique ecological regions that are becoming fragmented by agriculture, silviculture, and urban sprawl. Fragmentation of natural ecosystems often disrupts the ecological processes and services that sustain many biological processes and life itself. In order to safeguard the functionality of large ecosystem processes, threats to ecological function and conflicts in use of natural resources need to be identified and prioritized using a coordinated strategy.

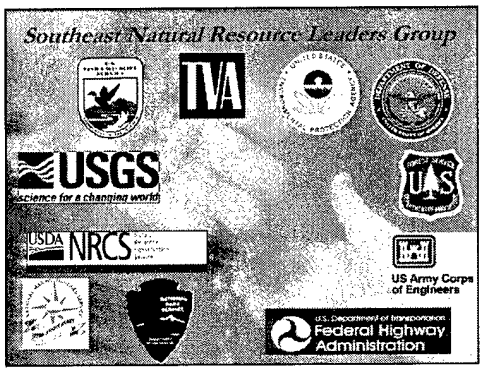
The U.S. Environmental Protection Agency has developed the Southeastern Ecological Framework (SEF) using the best available data, GIS technology, and ecologically based computer models. Delineation of an ecological framework can support a proactive approach for protecting natural resources instead of simply reacting in a crisis mode. Federal agencies charged with management of land and other natural resources in the southeastern U.S. are coordinating their efforts using the Southeastern Natural Resource Leaders Group (SNRLG). The SNRLG is composed of top-level managers from the various agencies. Federal agencies currently participating in the SNRLG include the EPA, DoD, DOE,

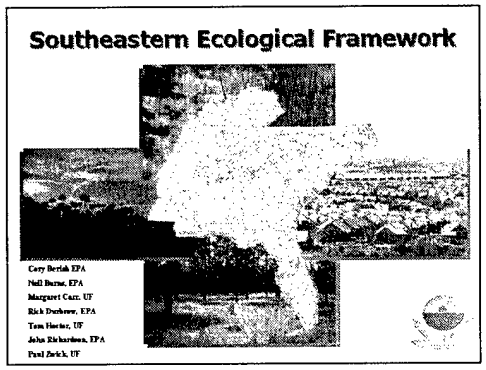
DOT, Forest Service, Fish and Wildlife Service, USGS, and TVA. Two specific projects use the SEF to connect Fort Bragg with Camp MacKoll in NC and managing DoD and DoE lands along the fall line ecoregion.

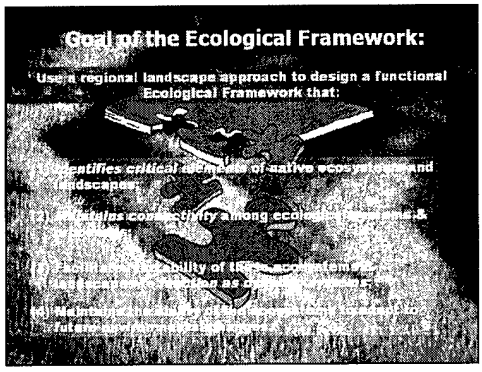
PRESENTATION: Cooperative Efforts of the Southeastern Natural Resource Leaders Group Using the Southeastern Ecological Framework

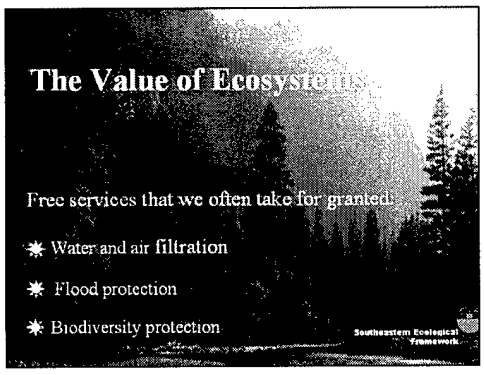










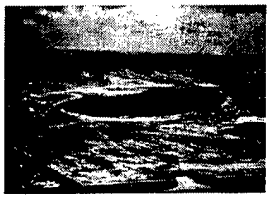


Current State of our Ecosystems

Ecosystems face destruction,
degradation and
fragmentation from:

- Intensive agriculture
- Urbanization
- Road building
- Channelized streams
- Fire suppression
- Recreation
- Pollution

Habitat Fragmentation



"Habitat fragmentation is the most serious threat to biological diversity and is the primary cause of the present extinction crisis."
(Wilcox and Murphy 1985)

Current Protection Efforts

Piece-meal protection - focuses on local species or individual populations

⇩

Leads to degradation of larger ecosystem and further fragmentation

⇩

Many large-scale processes no longer able to function

Outline for this Presentation

(1) Problem: Compliance history good but environmental quality not

(2) Tools: Southeastern Natural Resource Leaders Group (SENRLG)
EPA Regional Planning Council
EPA Strategic Environmental Assessment Corps (SEAC)
State and EPA Performance Partnership Agreements
State and EPA Performance Partnership Grants

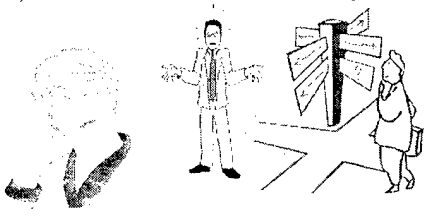
(3) Process: Cooperative Planning
Spatial co-occurrence of environmental issues

(4) Example: Southeastern Ecological Framework
Model, Results, and Applications

PROBLEM :

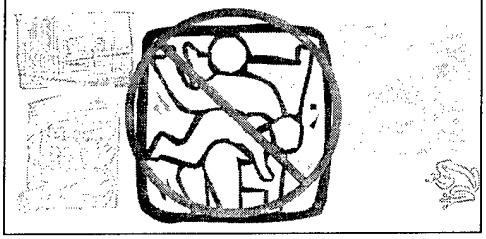
Compliance history of facilities is in good shape but:

1) Why do we still have environmental problems in some areas?
2) How can we address multi-media and cross-media pollution?



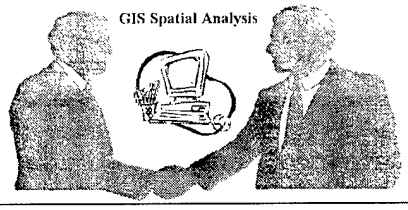
PROBLEM :

Simply counting violations and penalties does not improve environmental quality



TOOLS:

South Eastern Natural Resource Leaders Group
Performance Partnership Agreements
Performance Partnership Grants
EPA Region 4 Planning Council
GIS Spatial Analysis



TOOLS:

EPA Region 4

Planning Council

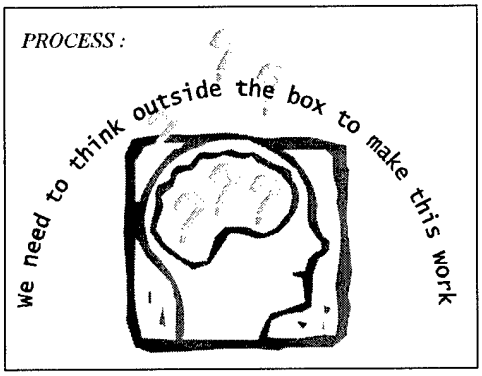
Water Air Waste EAD SESD

1) How to prioritize environmental issues?

2) Where should we focus our work/resources?

3) Why should we work there?

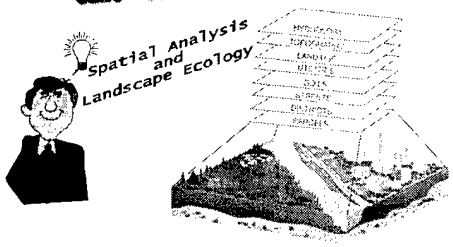
PROCESS :



PROCESS :

1) Identify environmental issues of common interest
2) Each party develops a prioritized list of those issues
3) GIS used to find spatial distribution and co-occurrence
4) Compare lists and agree on common priority issues
5) Discuss how to address those issues with tools available

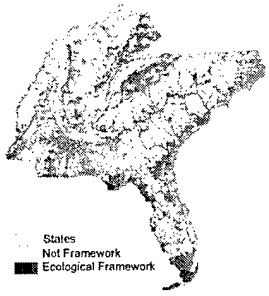
PROCESS : EPA Strategic Environmental Assessment Corps



EXAMPLES :

- **Southeastern Ecological Framework**
  - Connect ecologically important areas to maintain functional landscape ecosystem
  - Model, Results, and Applications
- **Recent Cooperation with State of Mississippi**
  - Performance Partnership Agreement
  - Water quality is degraded from agricultural runoff
  - Riparian land cover summary can guide water monitoring
  - Identifying industrial pollution prevention opportunities

Southeastern Ecological Framework



SOUTHEASTERN ECOLOGICAL FRAMEWORK

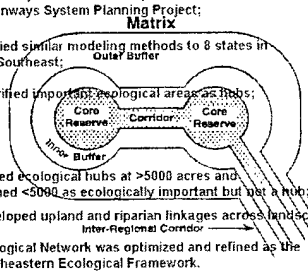
Potential Partnership Applications

- Protect drinking water sources
- Connect local green space initiatives into a regional context
- Target wetland mitigation banks and wetland restoration projects
- Specific habitat protection/restoration (e.g., longleaf pine forests)
- Connect federal conservation and military lands

Southeastern Ecological Framework

CREATING THE ECOLOGICAL MODEL

a) University of Florida developed Florida statewide Greenways System Planning Project;
b) Applied similar modeling methods to 8 states in the Southeast;
c) Identified important ecological areas as hubs;
d) Filtered ecological hubs at >5000 acres and retained <5000 as ecologically important but not a hub;
e) Developed upland and riparian linkages across landscape;
f) Ecological Network was optimized and refined as the Southeastern Ecological Framework.



Key Steps in the Model

Step 1 - Identify:
Areas of Ecological Significance

Step 2 - Filter:
(ecological hubs > 5000 acres)

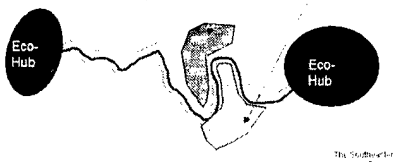
Step 3 - Delineate:
Landscape Linkages
(ecological cost surface)

Ecological Cost Surface Analysis

Find a path between ecological hubs representing the best "ecological pathway" between the hubs.

Cost is not monetary, but is ecological

(Avoid urban areas and intensive agriculture)

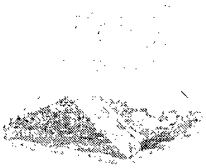


Priority Ecological Area Data Layers

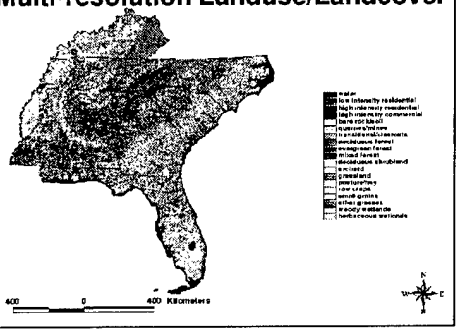
- Existing federal and conservation lands
- Wetlands and other unique ecosystems
  - Everglades, Okefenokee, Southern Appalachians
- Natural Heritage Program Data and Species Analyses
  - rare/sensitive listed species data (Florida, Georgia, Alabama)
  - significant natural areas (Florida and North Carolina)
- Priority water bodies and wetlands
  - shellfish harvest areas
  - wild and scenic rivers
  - aquatic preserves (Florida only)
  - fish nursery and spawning areas (North Carolina only)

Priority Ecological Area Data Layers (cont.)

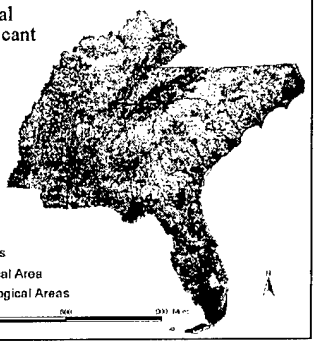
- Roadless areas (5,000 acres or larger)
- Potentially significant black bear habitat
- Areas with high stream reach densities
- Biodiversity hotspots
- Critical species conservation areas
- Areas with significant natural edge habitat or habitat diversity
- Areas with significant longleaf pine stands or "old growth" forest
- Coastal Barrier Resource Act Lands and National Estuarine Research Reserves



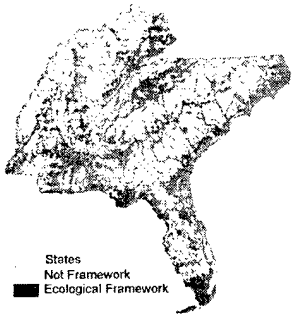
Multi-resolution Landuse/Landcover



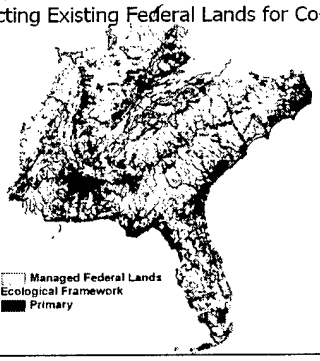
Priority Ecological Areas and Significant Ecological Areas

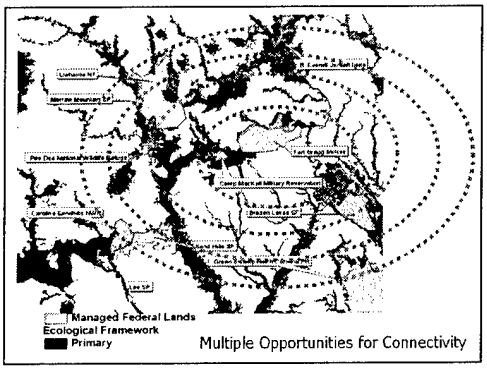


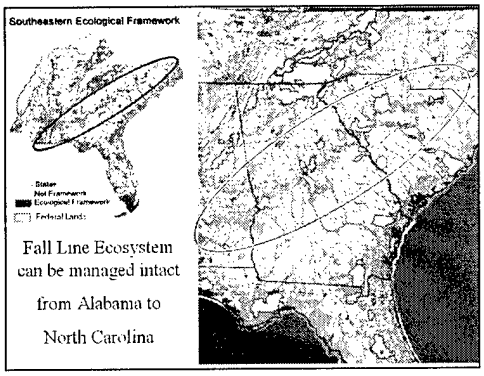
Southeastern Ecological Framework

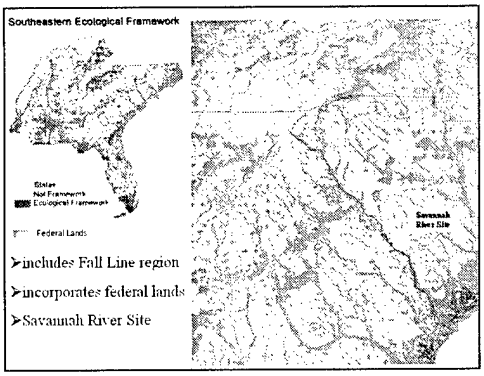


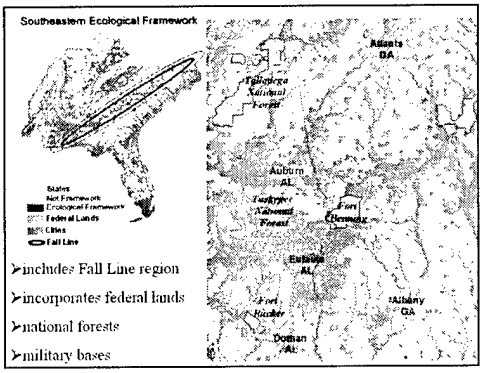
Connecting Existing Federal Lands for Co-benefits

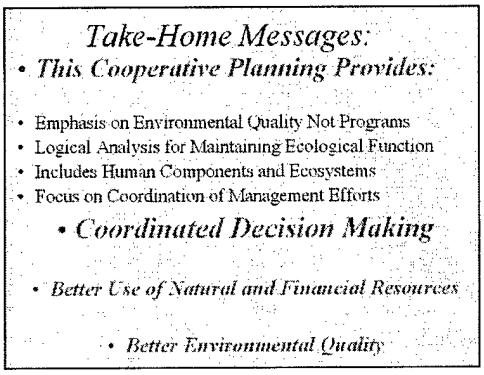


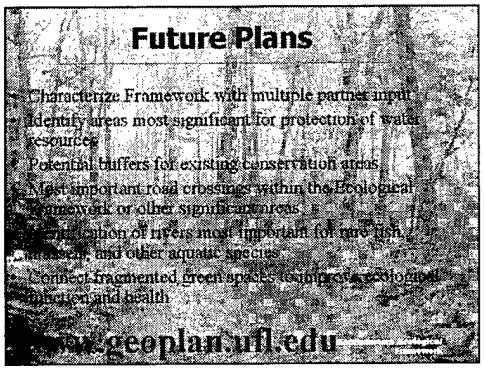


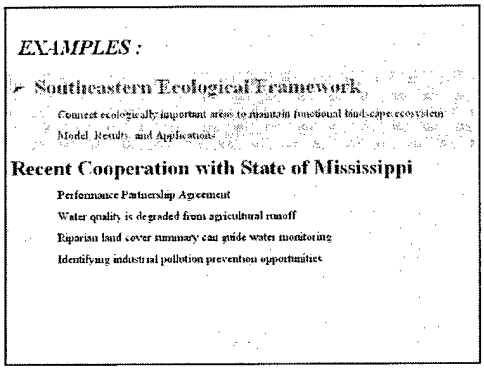

Southeastern Ecological Framework
Fall Line Ecosystem
can be managed intact
from Alabama to
North Carolina

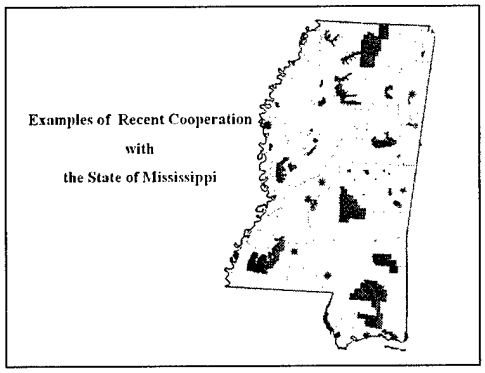

Southeastern Ecological Framework
➢includes Fall Line region
➢incorporates federal lands
➢Savannah River Site

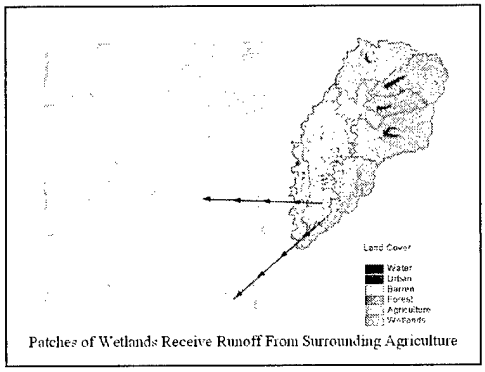

Southeastern Ecological Framework
➢includes Fall Line region
➢incorporates federal lands
➢national forests
➢military bases

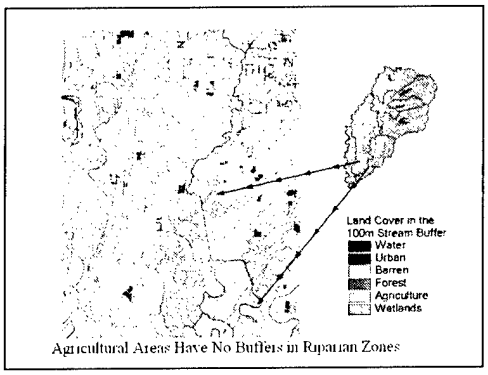

Take-Home Messages:
• This Cooperative Planning Provides:
• Emphasis on Environmental Quality Not Programs
• Logical Analysis for Maintaining Ecological Function
• Includes Human Components and Ecosystems
• Focus on Coordination of Management Efforts
• Coordinated Decision Making
• Better Use of Natural and Financial Resources
• Better Environmental Quality


Future Plans
Characterize Framework with multiple partner input
Identify areas most significant for protection of water resources
Potential buffers for existing conservation areas
Most important road crossings within the Ecological Framework or other significant areas
Identification of rivers most important for rare fish, mussels, and other aquatic species
Connect fragmented green spaces to improve ecological function and health
www.geoplan.ufl.edu

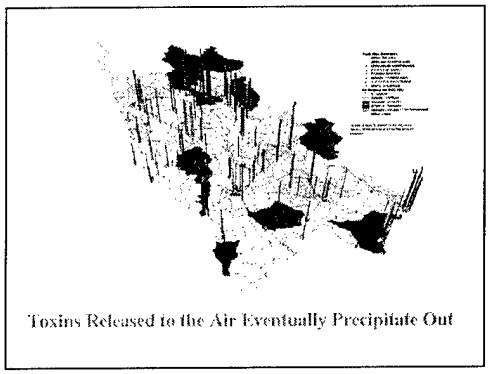

EXAMPLES :
➢ Southeastern Ecological Framework
Connect ecologically important areas to maintain functional landscape ecosystem
Model Results and Application
Recent Cooperation with State of Mississippi
Performance Partnership Agreement
Water quality is degraded from agricultural runoff
Riparian land cover summary can guide water monitoring
Identifying industrial pollution prevention opportunities

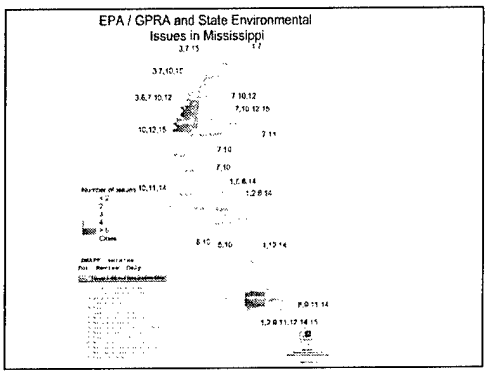

Examples of Recent Cooperation
with
the State of Mississippi


Land Cover
Water
Urban
Barren
Forest
Agriculture
Wetlands
Patches of Wetlands Receive Runoff From Surrounding Agriculture



Agricultural Areas Have No Buffers in Riparian Zones


Toxins Released to the Air Eventually Precipitate Out

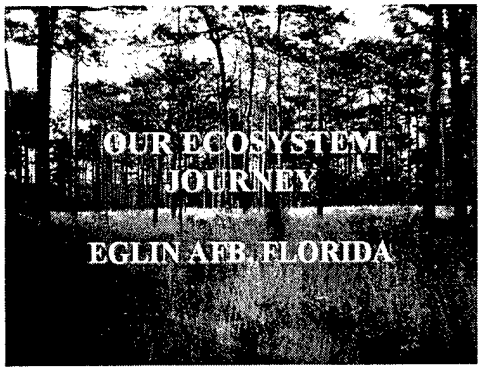


Regional Ecosystem Management Program in the Southwest: An Example from the Gulf Coast Eglin AFB

PRESENTERS: Rick McWhite and John Hiers

ABSTRACT: The military mission of Eglin Air Force Base provides a unique opportunity to demonstrate the ecological benefits and advantages to mission flexibility of an ecosystem management program. Planning, inventory, partnerships, and research have been cornerstones in Eglin's holistic approach to setting goals, addressing management uncertainties, and managing resources in a landscape context. To adapt to an ever-changing landscape, Eglin AFB's has committed to an ecological monitoring program to provide statistical trends in conservation targets, facilitate information exchange to managers for decision-making, and to develop new and efficient tools for inventory and analysis. Geographic information system (GIS) tools, such as spatial modeling and remote sensing, are used to efficiently meet these management challenges.

PRESENTATION: Eglin's Ecosystem Journey: defining adaptive management

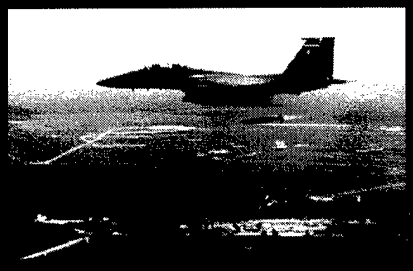


OUR ECOSYSTEM JOURNEY

1.MISSION
2.NATURAL RESOURCES
3.ECOLOGICAL MANAGEMENT PROGRAM

Eglin Air Force Base

1. Eglin Mission



Weapons Testing

Weapons Testing

2. NATURAL RESOURCES

Largest public ownership of longleaf pine
Largest single ownership of longleaf pine
Largest contiguous stands of old-growth longleaf pine in the world

Conservation Significance of Eglin`s Longleaf Pine Ecosystem

- Home to 11 federal and 96 state listed, rare, or local endemic species
- 4th largest Red-cockaded woodpecker population
- 95% of the Okaloosa darter`s range
- Indigo snake
- Largest population of flatwood salamanders west of the Apalachicola River (3 breeding populations)
- Only population in NW Florida of the endangered lichen *Cladonia perforata*

Conservation Significance of Eglin`s Longleaf Pine Ecosystems

5 seasonal resident T&E species
- largest concentration of loggerhead sea turtles in NW Florida
- Only nesting population of green sea turtles in NW Florida
- 3 known bald eagle nests
- Piping Plover
- Gulf Sturgeon

Conservation Significance of Eglin`s Longleaf Pine Systems

- 29 rare animal species to include
  - 5th largest population of black bears in the state
  - Largest concentration of reproductive sites within the entire range of the dusky gopher frog
  - Only population of burrowing owls in NW Florida
  - Largest population of snowy plovers in NW Florida
  - Only unlisted beach mouse population in NW Florida
  - Two new species of salamanders
  - Most of the known sites for the endemic bog frog
- 67 rare plant species
  - Eglin provides the majority of habitat for 4 species

3. ECOSYSTEM MANAGEMENT PROGRAM- 1989 to 2001

a. PLANNING
b. INVENTORIES
c. PARTNERSHIPS
d. RESEARCH
e. ADAPTIVE MANAGEMENT

a. PLANNING

Good planning is a necessity

"Plans are nothing. Planning is everything"
General Dwight D. Eisenhower
Supreme Allied Commander
World War II

a. PLANNING

- Ecosystem Management Plan- 1993-1997
- Transition INRMP- 1998-2001
- Drafting Cooperative INRMP- 2002-2006
- LESSIONS LEARNED- Continuous planning is better than surge efforts

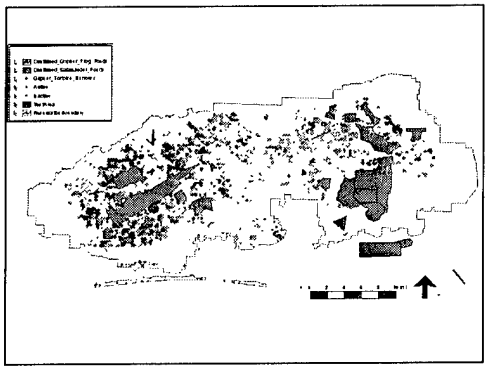
b. INVENTORIES

Defining the Present Landscape Context for Conservation and Management:

-What Resources are Present?
-What is their present condition?
-What as a manager are you going to do about those resources?

b. INVENTORIES

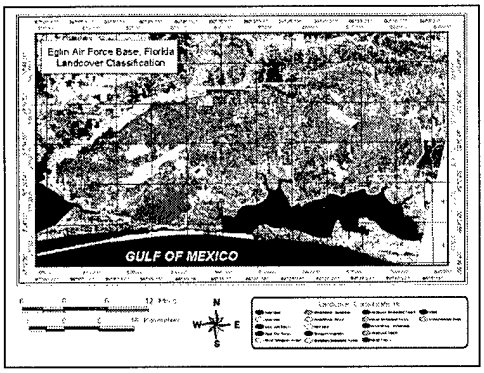
- Rare Plant Survey-1993-95
- Natural Communities Survey-1995-97
- T&E Species Surveys- 1989-93
- Wetland Surveys- 1995
- Neotropical Bird Surveys-1996-97
- Cape San Blas Ecological Study-1996-98



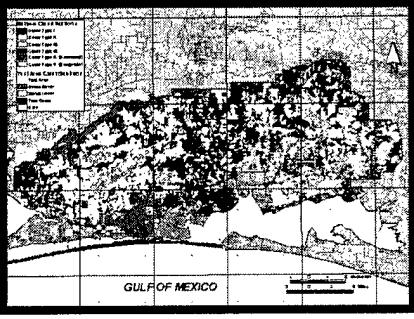
Off-Site Slash Plantations

Fire Suppressed Sandhills

Sand Pine Continuing to Displace Longleaf Pine



Land Classification by Cover Type



c. PARTNERSHIPS

- Gain a better global and regional perspective
- Benefit from scientific expertise
- Enhance learning (more minds working together to solve problems)

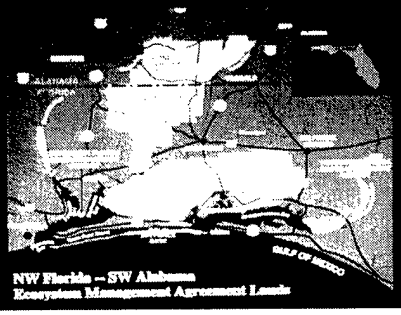
Types of Partnerships on Eglin

- Inventory
- Research
- Public Outreach
- Planning
- Coordination
- Ecological Monitoring

Efforts Beyond Eglin's Boundaries

- Gulf Coastal Plain Ecosystem Partnership (GCPEP)
  - Purpose is to:
    - Focus on a larger landscape of 840,000 acres
    - Share and exchange information and resources

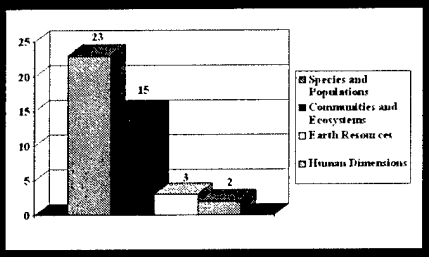
GCPEP



d. RESEARCH

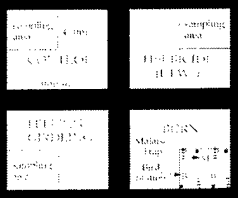
- Ecology and Population Dynamics of Black Black Bears
- Sea Turtle Nesting Biology
- Ecology of Okaloosa Darter
- Ecological Correlates of RCW, Foraging Preference, Habitat Use and Activity Area
- Understory Response to Herbicide

Inventory and Research Conducted on EAFB

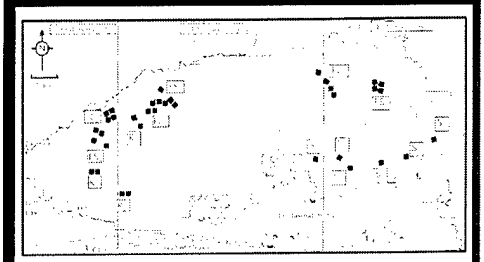


Longleaf Pine Restoration Experiment

Experimental Design for Restoration Treatments



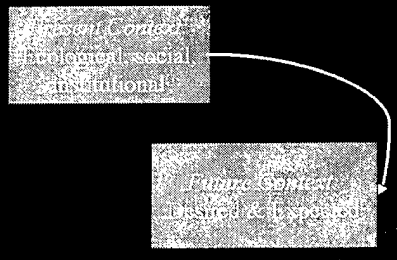
Longleaf Pine Restoration Experiment



c. ADAPTIVE MANAGEMENT

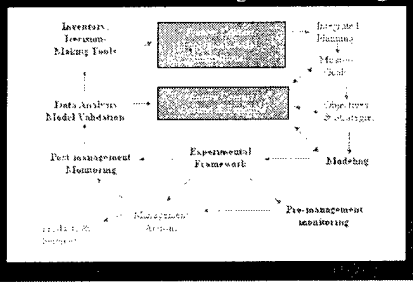
Integrating Adaptive Management, and Ecological Monitoring into the Eglin AFB Natural Resources Program

The Universal Management Challenge



Adaptive Management Process

And the Role of Ecological Monitoring



What to Monitor?

Site Conservation Planning and DFCs
Eglin has adopted The Nature Conservancy's site conservation planning process to identify *Conservation Targets* that are critical to long-term ecosystem health. The long-term (50-year) landscape goals for these targets is called the desired future condition.

Community Focal Targets:

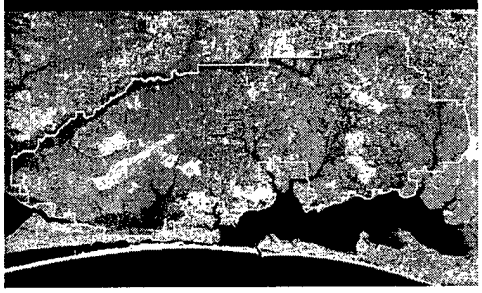
Longleaf Pine Sandhills
Longleaf Pine Flatwoods
Seepage Slopes
Steephead Ravines
Streamside Baygalls
Depression Marshes
Sandpine Scrub
Bottomland Hardwood Forests
Hydric Hammock
Dome Swamp
Riverine Aquatic

Species Focal Targets:

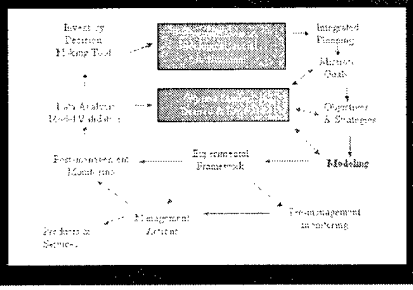
Red-cockaded woodpecker (*Picoides borealis*)
Flatwoods salamander (*Ambystoma cingulatum*)
Bog frog (*Rana okaloosae*)
Okaloosa darter (*Etheostoma okaloosae*)
Perforate reindeer lichen (*Cladonia perforata*)
Black bear (*Ursus americanus floridanus*)
Gopher tortoise (*Gopherus polyphemus*)
Beach mouse (*Paromyscus polionotus leucocephalus*)

Conservation Target:

Bottomland Hardwood Forest



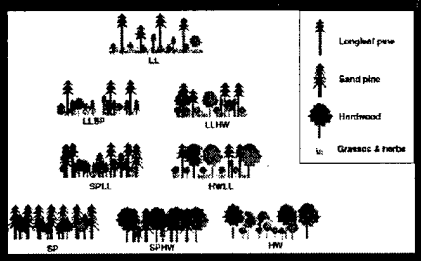
The Role of Modeling:



U of F/TNC Fire Model

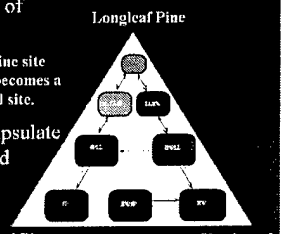
- Developed to better understand the implications of various fire regimes and strategies
- Useful tool to convey information to decision makers regarding budgets and manpower
- 3 Different scenarios
  - NM10 Maintenance (10 large and small burns) 90,000 ac reservation wide
    NR10 Rotation (10 large and small burns) 90,000 ac reservation wide
  - NM15 Maintenance (15 large and small burns) 135,000 ac reservation wide
  - NR15 Rotation (15 large and small burns) 135,000 ac reservation wide
  - NM 20 Maintenance (20 large and small burns) 180,000 ac reservation wide
    NR 20 Rotation (20 large and small burns) 180,000 ac reservation wide
    Large burn 2,400 acres
  - Small burn 600 acres

Conceptual Model of Eglin - Vegetation Types



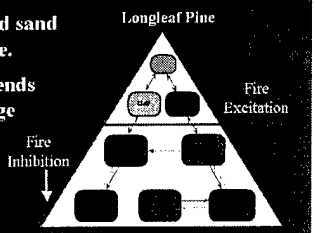
Eglin Fire/Forest Model

- A site changes state based upon a set of transition rules.
  - e.g. If a longleaf pine site does not burn, it becomes a longleaf/hardwood site.
- These rules encapsulate effects of fire and succession.

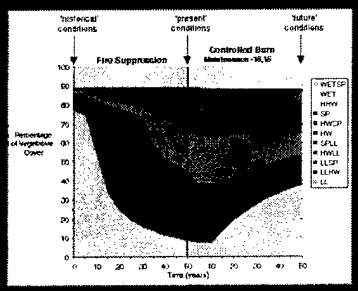


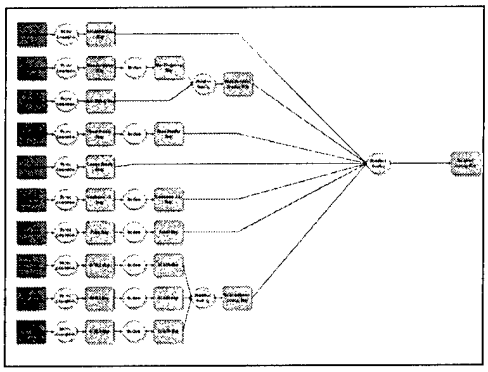
Fire and Vegetation Interact

- **Longleaf encourages fire**
- **Hardwoods and sand pine inhibit fire.**
- **Sand pine depends upon long-range dispersal to spread.**

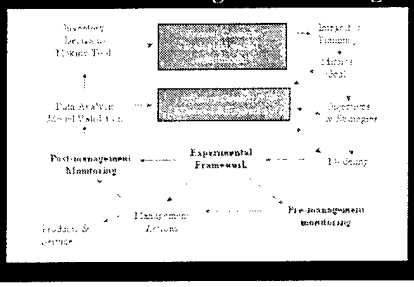


A Scenario Time Series



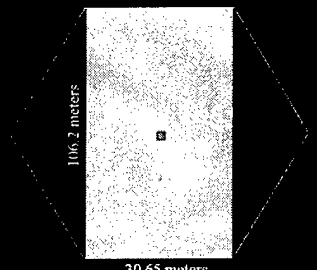


Adaptive Management Process:
The Role of Ecological Monitoring

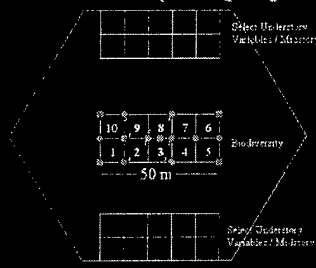


Stratified Random Sampling Points for Sandhill Monitoring

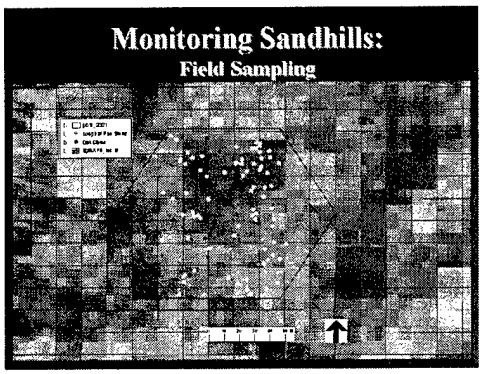
Nested Overstory Sampling Plot

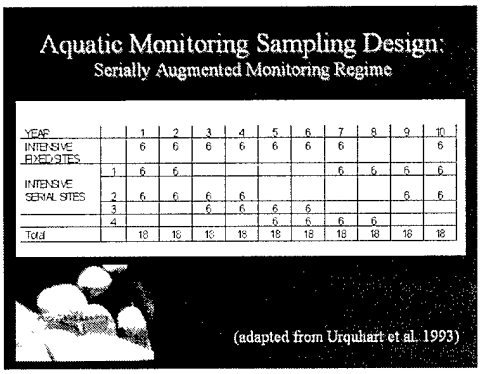


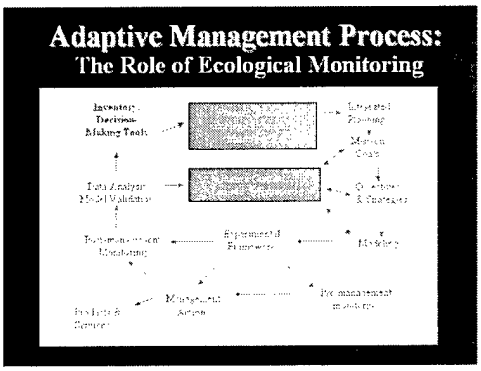
Sandhill Understory Sampling Design

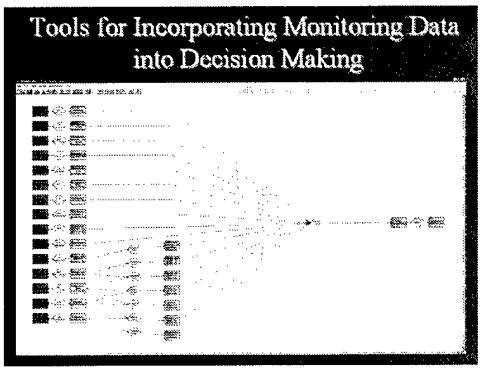


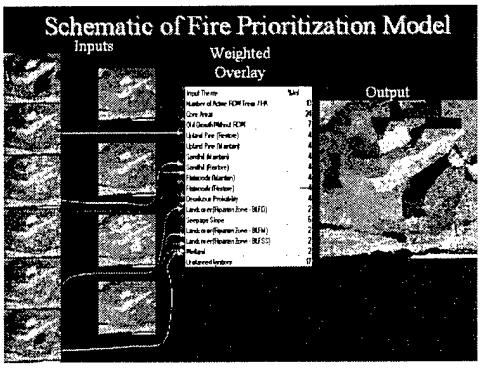
Peet et al. 1998

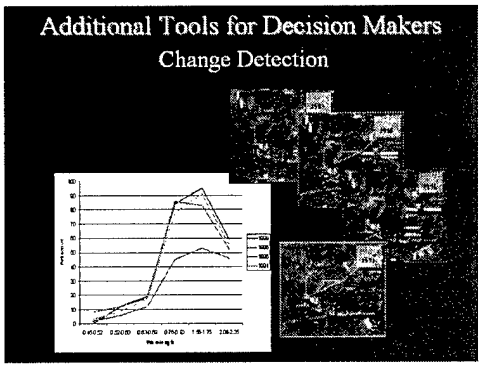

Monitoring Sandhills:
Field Sampling


Aquatic Monitoring Sampling Design:
Serially Augmented Monitoring Regime
YEAR 1 2 3 4 5 6 7 8 9 10
INTENSIVE FIXED SITES 6 6 6 6 6 6 6 6
INTENSIVE SERIAL SITES 1 6 6 6 6 6 6
2 6 6 6 6 6 6
3 6 6 6 6
4 6 6 6 6
Total 18 18 18 18 18 18 18 18 18 18
(adapted from Urquhart et al. 1993)


Adaptive Management Process:
The Role of Ecological Monitoring


Tools for Incorporating Monitoring Data into Decision Making


Schematic of Fire Prioritization Model
Inputs
Weighted Overlay
Output


Additional Tools for Decision Makers
Change Detection

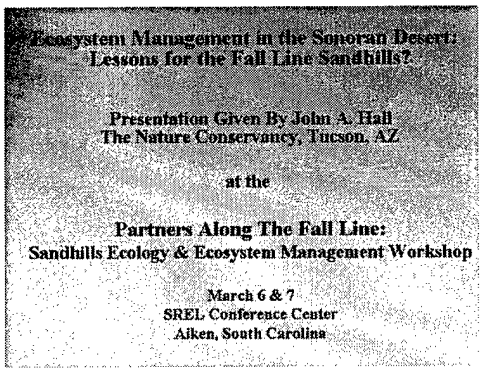

Stewardship & Conservation

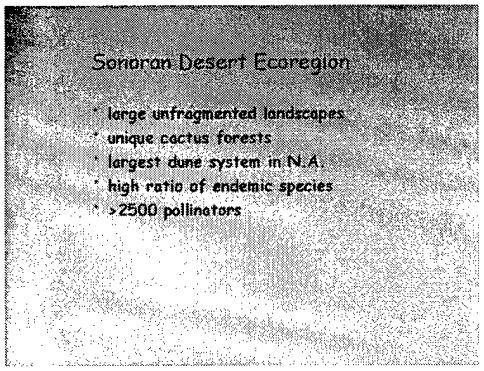
Regional Ecosystem Management Planning in the Southwest: An Example from the Sonoran Desert

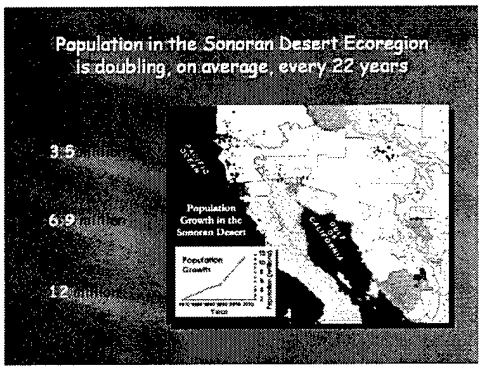
PRESENTER: John Hall

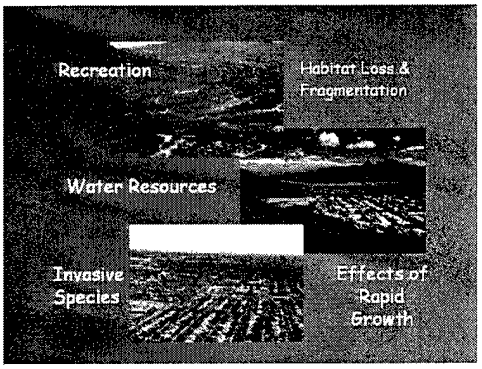
ABSTRACT: How transferable are the applications of ecosystem approaches to natural resources management from one ecological unit to another? Can lessons learned from the Sonoran Desert Ecoregion help guide ecosystem management approaches in the Sandhills ecological subsection of the southeastern U.S? Through funding in part from the Department of Defense's Legacy Resource Program, The Nature Conservancy and its partners recently completed an ecological analysis of conservation priorities in the Sonoran Desert Ecoregion: a binational ecological region of unique biodiversity that also is characterized by rapid human population growth. A network of one hundred landscape-scale conservation areas—portfolio sites, which if in aggregate are managed appropriately should preserve most of the ecoregion's biodiversity—were identified in accordance with a standardized methodology developed by the Conservancy to support ecoregional planning and using expert input in regard to occurrences of communities and species of conservation concern. On the U.S. side of the border, most of the conservation areas contained public lands. The Conservancy's assessment of management status on public lands contributing to the Sonoran Desert conservation portfolio identified only about one quarter of the land ownership as adequately managed for biodiversity conservation and most management attention focused on single, listed species issues. To help facilitate the efforts of public land managers to manage for biodiversity, the Conservancy is using development of the Barry M. Goldwater Range's Integrated Natural Resources Management Plan to incorporate a biodiversity management framework into public land management practices that uses a coarse/fine filter approach (in which the goal is biotic representation across spatial scales of occurrence, taxonomic breadth, and levels of rarity) to capture biodiversity and accounts for ecological processes, landscape and regional contexts, desired future ecological conditions, and measures of success. Although some differences, such as the degree of public versus private land and the amount of ecosystem alteration, may distinguish the Sonoran Desert Ecoregion from the Sandhill ecological subsection, sufficient similarity exists to enable many lessons to be transferred: develop a vision of desired future ecological conditions, coordinate management with neighbors and partners to combat invasive species and to gauge success on regional scales, and use an ecosystem approach to base management strategies, including accounting for ecological processes that establish and maintain biotic communities irrespective of jurisdictional boundaries.

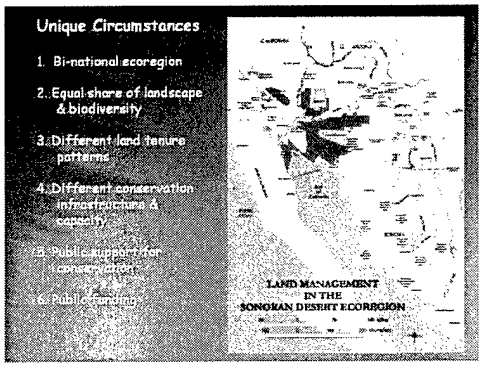
PRESENTATION: Ecosystem Management in the Sonoran Desert: Lessons for the Fall Line Sandhills?

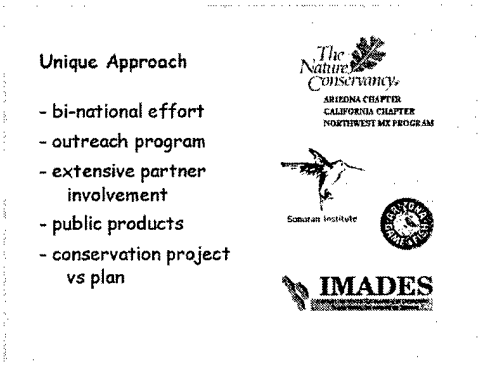


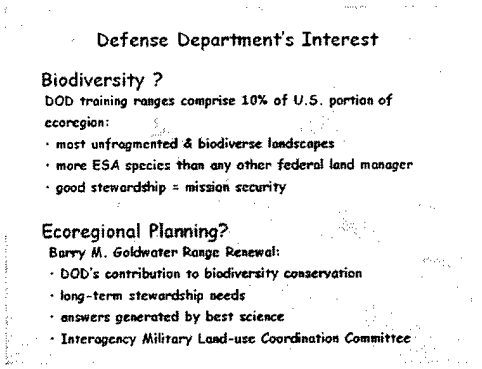


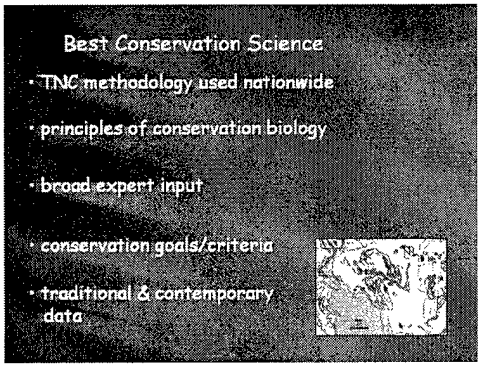










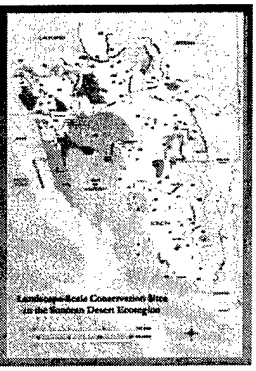


Network of
100 Conservation Sites

~50% of ecoregion

2 size classes

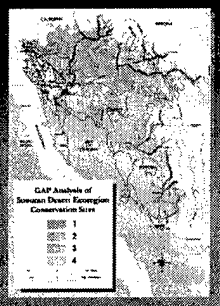
"Heart of the Desert"

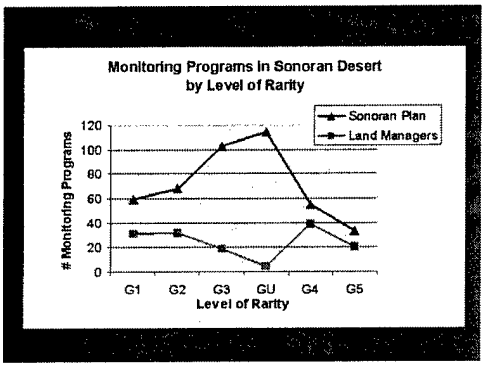


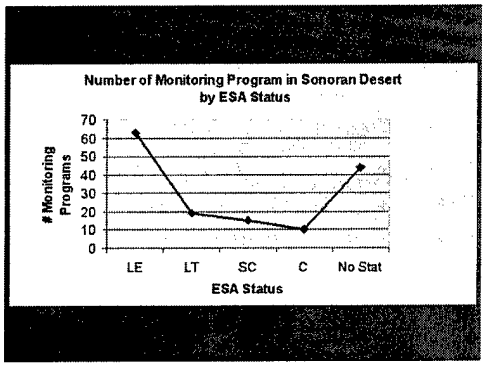
Conservation Sites &
Status of U.S. Public
Lands

BLM 3.1 million acres
DOD 2.3 million
FWS 1.5 million
State 0.6 million
NPS 0.4 million
USFS 0.3 million

total 8.2 million (78%)
w/in U.S. public lands

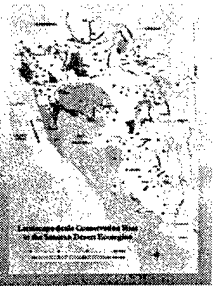


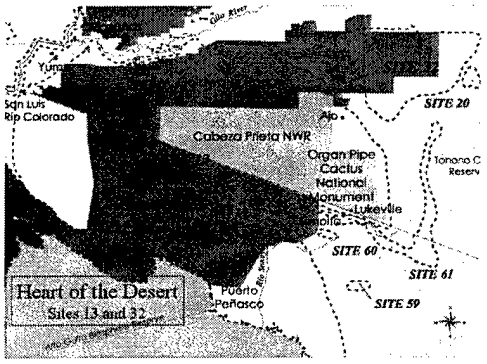




Translating the Ecoregional Blueprint to
On-the-Ground Conservation Action

- Heart of the Desert—
  no regrets
- Highest number of
  ecoregional
  biodiversity elements
- High profile listed
  species





Complex Missions with Multiple Mandates

1. people
2. real estate
3. minerals
4. livestock
5. hydro power
6. water supplies
7. military training
8. forestry/logging
9. recreation
10. fish & wildlife
11. endangered species
12. wild horses & burros

Why start with the Barry M. Goldwater Range?

- Sikes Act/MLWA of 1999
- DoD Interest
- Multi-agency Process
- Intact Desert Ecosystem
- Public Visibility
- New Role for DoD Agencies
- Conducive Planning Context for Developing a Biodiversity Management Framework

Benefits to DoD of Embarking on an Ecosystem-based Planning Approach

Demonstrate Ability to Manage Biodiversity through an Informed Decision-making Process

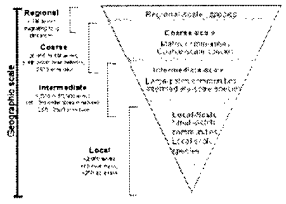
Opportunities for Coordinated Management

Regional Biodiversity Context

- **Relative significance of the BMGR**
- **Account for Regional Trends**
- **Maintain what You Have**
- **Continuity of Biodiversity Elements from the Ecoregion to the Site**

Documented Science-based Process

- Ecosystem-based approach
- Umbrella strategy
- Accounts for ecological processes and landscape context
- Expert Informed
- Extensive Ecological Characterization Information



Products

- **13 Natural Community Conservation Elements**
- **12 Species Conservation Elements**
  - **8 individual species**
  - **4 guilds**

Synthesis and Application: Basis for Management Action

Goal-based

Measures of Success

Spatially Explicit

Management Standards

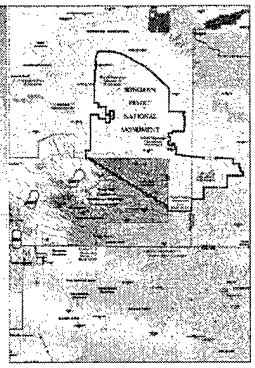
What Will Success Look Like?

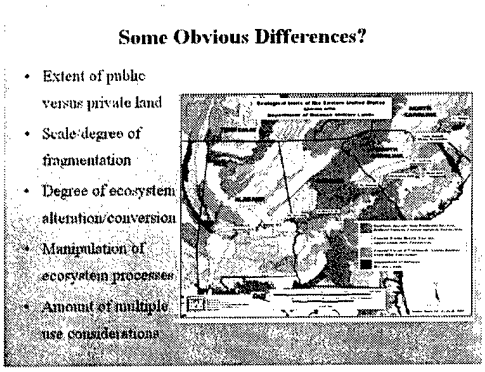
- Ecosystem Level Conservation
- Preserved Training (Mission) Options Management Standards
- Demonstrated Pro-active Management Exportable Process

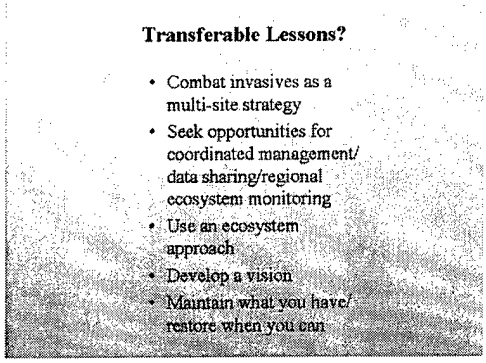
Future Opportunities

Coordinated Planning and Management

- Focus on Invasives
- Regional Ecosystem Monitoring





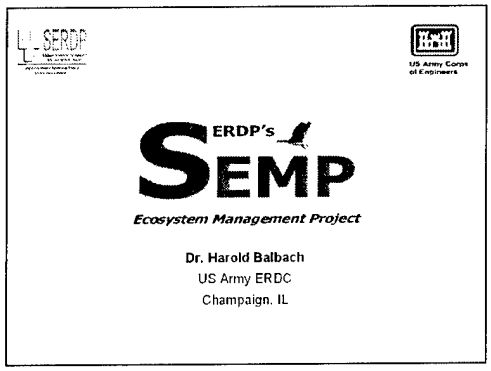


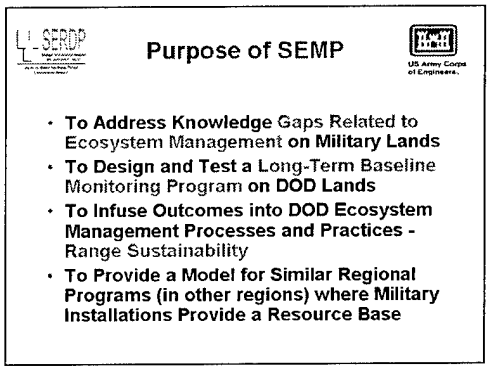
Structure and Progress of SEMP Research

PRESENTER: Hal Balbach

ABSTRACT: Dr. Hal Balbach, SEMP Project Director, provided an introduction to the objective of SEMP, and the various efforts which fell within it. Basic criteria for indicators were presented, and the makeup of the SEMP Technical Advisory Committee described. He reviewed briefly the five research projects focused on indicators and thresholds. The Environmental Characterization and Monitoring Initiative (ECMI), which was established to collect and store basic environmental and meteorological data, was described and some examples of its spatial, aquatic, and terrestrial components shown.

PRESENTATION: Structure and Progress of SEMP Research





Key Properties and Processes
(Form the Basis for SEMP Research)

Those for which fundamental understanding is required to ensure goals of sustainability can be met

- Hydrologic flux and storage
- Biological productivity
- Biogeochemical cycling and storage
- Decomposition
- Maintenance of biological diversity

(Christensen, N.L. et al. 1996. The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management. Ecological Applications 6(3):665-691.)

Criteria for Indicators*

- Are easily measurable
- Are sensitive to stresses of system
- Respond to stress in a predictable manner
- Signify an impending change in key characteristics of the ecological system
- Experience changes that can be averted by management actions
- Together with the full suite of indicators, provide a measure of coverage of the key gradients across the ecological systems (e.g., soils, vegetation types, temperature, etc.)
- Have a known response to natural disturbances and changes over time
- Have low variability in response

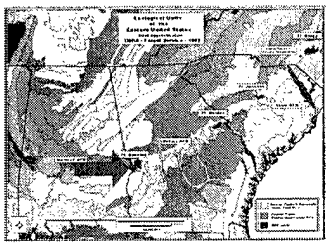
* Dale, V.H. and Beyeler, S.C. 2001. Challenges in the development and use of ecological indicators. *Ecological Indicators*, v.1

Technical Advisory Committee for SEMP

- Dr. Mary Barber, Ecological Society of America, SAB Member
- Mr. Peter Boice, Director of Conservation Programs, Deputy Undersecretary for Defense, Environmental Security, TTAWG Member
- Dr. Roger Dahlman, Program Manager, U.S. Department of Energy, TTAWG Member
- Dr. Mark Fenn, U.S. Department of Agriculture, Forest Service
- Dr. Penny Firth, National Science Foundation
- Dr. John Hall, The Nature Conservancy
- Mr. Richard McWhite, Natural Resources Chief, Eglin Air Force Base
- Dr. Doug Ripley, Headquarters, Air Force, TTAWG Member
- Dr. James Spotila, Drexel University
- Dr. J. Whitfield Gibbons, Savannah River Ecology Lab and University of Georgia

Southeastern Ecosystem Focus Desired:
Fort Benning Volunteers to Host the Project

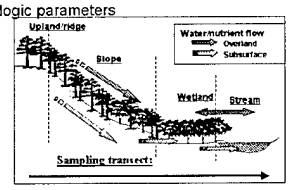
- **Ft. Benning spans two major systems: Sand Hills and Coastal Plain**
- **Both support many DOD facilities**
- **Excellent opportunity to extend knowledge to other sites**



Determination of Indicators of Ecological Change

University of Florida (and Purdue University) – PI: W. DeBusk

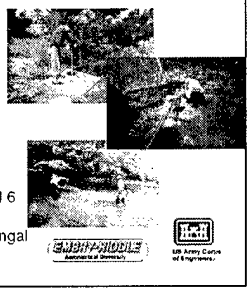
- Hillslope Hydrology - 2 sub-watersheds studied
- Data collection - hydrologic parameters
- Biogeochemical sampling at 300 sites
- Analysis of soil chemistry and microbiology



Development of Ecological Indicator Guilds for Land Management

ERDC/Embry-Riddle – PI: A. Krzysik and H. Balbach

- Conducted intraproject "workshop" of all PIs
- Examined developmental instability, including photosynthetic responses
- Surveyed terrestrial invertebrates and fishes
- Installed 36 lysimeters and 6 slope profilometer arrays
- Examined bacterial and fungal diversity at these sites

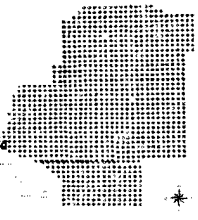


Indicators of Ecological Change

Oak Ridge National Laboratory – PI: V. Dale

- **Corrected and completed 1827 forest cover map**
- **Processed storm-affected stream samples**
- **Resampled benthic invertebrates in 6 streams**
- **Analyzing understory vegetation and soil microbiology from plots established in different disturbance types**
- **Utilizing alternate statistical analyses appropriate to multivariate systems**

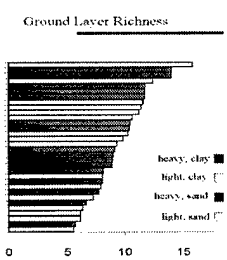
Ft. Benning 1827 Vegetation Map



Thresholds of Disturbance: Land Mgmt Effects on Vegetation and Nitrogen Dynamics

University of Georgia (SREL) PI: B. Collins

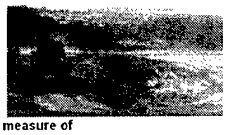
- Identified sites.
- Baseline vegetation survey
- Sampled soil texture to determine if selected sites were accurately categorized
- Conducted disturbance survey to determine the pre-treatment impact of land use in each site
- Upland mixed pine-hardwood sites subjected to prescribed burning during winter 1999-2000 were chosen



Disturbance of Soil Organic Matter and Nitrogen Dynamics: Implications for Soil and Water Quality

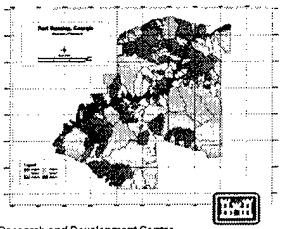
Oak Ridge National laboratory
PI: C. Garten

- Analyzed soil samples from 40 sites under 5 land covers; correlated with V. Dale's study
- Emphasis on:
  - C:N ratios
  - Particulate OM
  - N mineralization potential
  - Soil aggregate stability
- LU/LC correlation will require measure of military use/impact



Environmental Characterization and Monitoring Initiative (ECMI)

- Inventory and Document Existing Data and On-going Monitoring Programs
- Design the Baseline Monitoring Program
- Implement the Baseline Monitoring Program
- Establish and Maintain a Data Repository
- Adapt the Monitoring Program



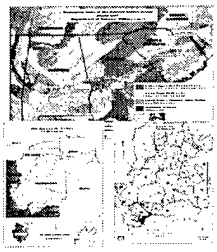
US Army Engineer Research and Development Center

US Army Corps of Engineers

ECMI Spatial Component

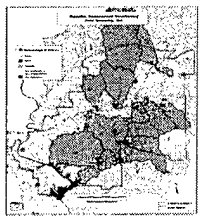
Three spatial contexts

- Regional is the portion of USGS HUC #03130003
- Watershed scale refers to the watershed-based units shown
- Installation scale refers to the Fort Benning boundary



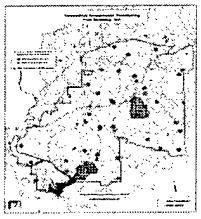
ECMI Aquatic Component

- Meteorology stations (10)
- Surface water flow
- Surface water quality
- Rapid Bioassessment Protocol (RBP)
  - 8-10 Watershed locations
- Aquatic productivity and decomposition
  - 5 locations
- Ground water level
  - 5 watershed locations



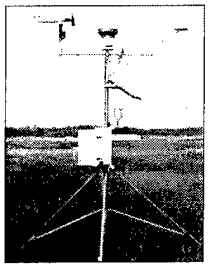
ECMI Terrestrial Component

- Net primary productivity (NPP)
  - Regional NPP from NASA Earth Observing Satellite
- Land cover from Landsat ETM
  - Land cover type
  - Vegetation density indices
- Land cover pattern
  - Geostatistical processing
- Soil erosion/deposition and woody productivity
  - Watershed and installation scale



Meteorology Monitoring

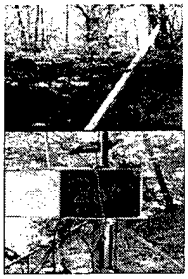
- Current Status
  - 10 Met Stations in place
  - Yearly recalibration and sensor maintenance 1Q01
    - Air temperature
    - Relative humidity
    - Barometric pressure
    - Solar radiation
    - Wind speed
    - Wind direction
    - Precipitation
    - Evaporation (1 station)



Hydrological Monitoring

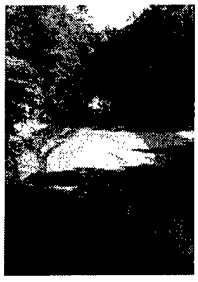
Current Status

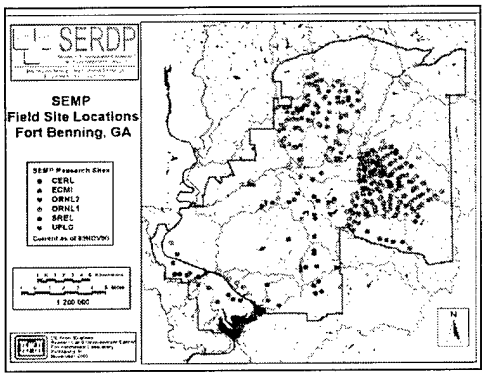
- Sustained drought conditions during FY00 to present required that full hydro units be pulled
- Currently monitoring stream levels only in Randall, Oswichee, Little Pine Knot, Sally Branch, Bonham, and Upatoi Creeks
- Full hydro units (surface water flow and quality) will be deployed once stream flow is re-established

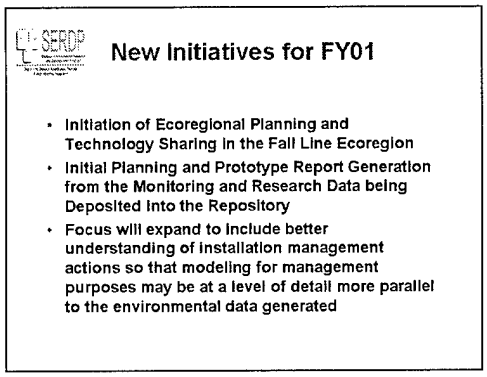


Aquatic Monitoring

- Current Status
  - Sustained drought conditions during FY00 to present and subsequent low or no stream flow have delayed aquatic monitoring
  - If drought conditions persist into 1Q FY01, aquatic monitoring will be executed only on those streams with adequate flow, e.g., Upatoi
- Available Data
  - None at present
- Development Schedule
  - Data collection 1Q FY01
  - Data on repository 3Q FY01







Poster Presentation: The Impact of Lightning on Longleaf Pine Ecosystems

PRESENTER: Kenneth W. Outcalt

ABSTRACT: The importance of lightning as an ignition source for the fire driven longleaf pine (*Pinus palustris*) ecosystem is widely recognized. Lightning also impacts this system on a smaller scale by causing individual tree mortality. The objective of this study was to determine the level of mortality due to lightning activity at the Department of Energy's Savannah River Site located in west central South Carolina. A total of eight stands at three locations containing 255 ha were surveyed and then monitored for lightning mortality. The initial survey showed the stands contained a mean standing snag density of 5.4/ha with an average diameter of 18.3 cm. Over a 3-year period, lightning killed 77 trees or 1 tree/10 ha/yr. Lightning associated mortality from bark beetle attacks on adjacent trees was 1 tree/13 ha/yr. The probability of a tree being struck by lightning increased as a function of tree height in an exponential relationship that had an r squared of 0.94. Thus, lightning directly or indirectly kills 1 tree/5 ha/yr in longleaf stands at Savannah River Site. This is a small but continuous and significant disturbance process that kills the larger trees in the stand and creates canopy openings, snags, and coarse woody debris.

PRESENTATION: Lightning

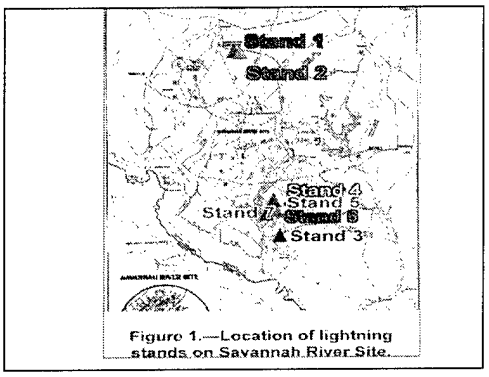


Figure 1.—Location of lightning stands on Savannah River Site.

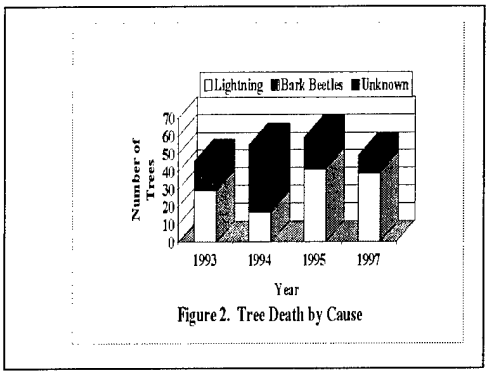


Figure 2. Tree Death by Cause

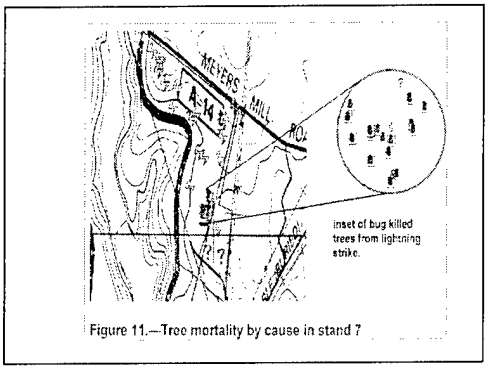


Figure 11.—Tree mortality by cause in stand 7

Poster Presentation: Relationship of Coarse Woody Debris to Red-Cockaded Woodpecker Prey Diversity and Abundance

PRESENTERS: George S. Horn and James L. Hanula

ABSTRACT: Red-cockaded woodpeckers (*Picoides borealis*) forage almost exclusively on the bole of live pine trees, however their arthropod prey are not confined to this habitat but are often found in or near coarse woody debris. We used crawl traps to capture arthropods crawling up loblolly pine (*Pinus taeda*) tree boles to determine if removal of woody debris affected prey availability for this endangered woodpecker and other bark-foraging species. In addition, we utilized burlap bands wrapped around trees and cardboard panels placed on the ground that harbor arthropods so that they could be easily observed. Woody debris was removed annually from four 9 ha plots beginning in 1997, and arthropod diversity, abundance, and biomass were compared to undisturbed controls. Crawl traps captured 27 orders of arthropods while 20 arthropod orders were observed under burlap bands and cardboard panels. The most abundant orders collected from crawl traps were Homoptera (primarily aphids) and Hymenoptera (mostly ants). The most common groups observed underneath cardboard panels were the Isoptera (termites), and the most common taxa under burlap bands were the

Blattaria (woodroaches). Overall, arthropod abundance or biomass captured in crawl trap was similar in control and coarse woody debris removal plots. However, we observed a significantly higher abundance of arthropods under burlap bands and cardboard panels in control plots. Our results suggest that removal of coarse woody debris from pine forests reduces overall arthropod abundance available to the Red-cockaded woodpecker, and it is likely that in the long-term certain groups will be reduced as well.

5 Breakout Sessions and Summaries

After the presentations, which provided a setting for the workshop, a series of breakout sessions were conducted for the participants to discuss several topic areas and provide a consensus for the major issues. A series of potential breakout topics were nominated by the participants (Table 1).

Table 1. Possible breakout session topics.

Longleaf Pine Ecosystem Restoration
Desired Future Conditions
Social/Economic/Ecological
Stewardship Sustainable Mission
Single Use vs. Multi-Use
Monitoring Principles Protocols Biological
Key Questions for Region
On-Ground Management vs. Limited Access Monitoring
Fire (Pine Roots)
Connectiveness vs. Isolation
Strategies for Outside-the-Fence
Single Species vs. Multi-Species Management
Regional Context to Management
Functionality for Fragmented Ecosystem
Defining the Fall Line Region
Requirements for Prediction
Next Step Re: Ecosystem, Issues and Partnering
Fire Management. Use
Aquatic System in SE
Groundcover in LL Pine
SEMP Outcomes, Incomes, and Extensions
Use of SE Regional Framework

The participants then voted for the three topics that were felt to be the most pertinent to their concerns. The four areas with the greatest number of votes became the breakout session topics. The topics for the breakout sessions were (with session monitors):

1. Regional Strategies, Goals, and Clustering (Charles Van Sickle and John Hall)
2. Longleaf Pine (Bill Otrosina)
3. SEMP Outcomes, Incomes, and Extensions (Hal Balbach and Teresa Aden)
4. Monitoring (Rick McWhite and Roger Dahlman)

Participants joined a breakout group for a period of about 30 minutes during which time the topic was discussed, conclusions and recommendations reached, largely by consensus. After that half hour was complete, participants joined a different breakout-group to discuss, recommend, and further conclude. This was done once more. By this means, most individuals were able to participate in most of the topics of greatest interest to them and benefit from the observations and recommendations of previous discussions. At the end of this period, the session monitors summarized and presented the major issues and recommendations that emerged within their breakout groups. A brief outline of these presentations follows.

Regional Strategic Goals (Group 1)

Concerns:

- Regional Soc-Economic Dimensions
- Connectivity Issues
- Ecosystem Management Endpoints (Regional Context)
- Landscape-Scale Functionally
- Alternative Futures
- Coordinated Management Strategies Fire/Invasive/Etc.
- Data Sharing/Practice Sharing
- Regional Monitoring
- Regional Assessment Vision
- Regional Cooperative Framework

Actions:

Define Geographic Scope

Identify Partners/Stake Holders

- Audiences
- Government. Entities
- Commercial
- Private
- Academic
- Key Individuals
- Cooperative Extensions
- Tribes

Identify Purposes

Define Organizational Structure

Develop Charter

"Rules" of Participation

Role of Advisory Bodies Outreach

Information Sharing

Coordination Programs and Jurisdictions

Integration of Conservation and Sustainable Development

Facilitate Organizational Mission

Address Critical Regional/Emerging Issues that fall between organizational gaps

- No one entity is responsible
- But all affects

Resources

Conflicting Agency/Regulation

Mandates/Rules

Addressing Global/Regional Changes That May Affect Ecological/Social/ Economic Trends in the Region

Data Issues

Water Issues (flow rates, improvements, and water quality)

Access Funding Sources

Regional Data Synthesis Analysis (Regional Assessment)

Setting Regional/Site

Resource Construction Priorities

Outreach and Education

Public Developers

Human Dimensions of Conservation

Humans are both as affected by conservation actions and how they are a threat

Regional Land-Use Planning Issues

Growth Management/Urban Sprawl/Encroachment

NEPP/ESA Coordination

Defining Geographic Scope Considerations

(Need to form a sub-committee to address this)

What to use? Watersheds?

Terrestrial veg (Longleaf Pine)

Soil

Land Uses

Ownership

Ecological Society of America (ESA) Issues

Relevance to SEMP

Social Economic Pressures Threats

Ecological Subscription

Physiographic Region

Conservation Ethic

Purposes:

Address Smoke Management. Issues

Defining Data Gaps/Research Gaps

Cross-Regional Outreach and Sharing

Coordination w/other Regional Organizations

Document A Model Framework for Regional Cooperative Org

Regional Disturbance Regimes

Projecting Impacts of Future Mission Charges

Purposes

Identification of Strategies to Address Habitat Fragmentation

Southern Appalachians

Original Organizing Principle: Biosphere Reserves

Figure 7. Teresa Davo and others mulling over ideas at a break in the breakout sessions.

Original Participants:

FS

NPS

DOE

TVP

BlueRidge Parkway

EPA

USGS

Better Coordination

Between Land Management./Agency Programs/Regulators/Fed State Counties

Agency Subcommittee Tasks:

Define Geographic Scope

Purposes of Cooperative Framework

Benefits Individual Collectively to Region

Timeline:

Convene Steering Committee by 5/1

Develop Definitions by 9/1

Brief SENTL LG

Preliminary - April 01

Fall Briefing - Oct 01

EPA/DoD Conf. Atlanta - June 01

Regional Strategies/Goals:

Identified topics Subsumed by the Broad Issue

Identified the Need for a Regional Cooperative Framework (Partnership)

Listed Considerations

Listed Potential Purposes of the Partnership

Listed Considerations follow from definition of Geographical Scope

Identified Need to Form a "Taskforce" to Define:

Geographic Scope

Purposes

Benefits

Members: DoD/DOE/EPA/FWS/TWC (FC/CORPS)

Brief SENR Leaders Group

Identified Assumptions

There is a:

1. Need for Better Coordination Between Land Management. Agencies Themselves and the Regulatory Community
2. Demonstration Benefits to the Mission of each Participating Organization

3. Model Regional Frameworks exist that Demonstrate Regional Cooperative Framework
4. Efficiencies are gained by Sharing Information, Goals, Frameworks and Standards Management. Tools and Practices Economies of Scale
5. The "Region" lacks a Framework to Build a Vision, Develop Priorities and Consensus
6. A Regional "Leaders" Group Exists to Facilitate Forming a Regional Partnership

Regional Strategic Goals Summary

- Define: Purpose, Region, Organizational Structure, Stakeholders, Benefits to Stakeholders, needed data
- Purposes: Define Research Gap & Data Gaps, Build Consensus, provide for coordination and data sharing, predict and proactively mitigate undesirable trends
- Develop Organizational Mission, Standard Presentation, Information Sharing, Educational materials
- Main Issues: Growth Management, Urban Sprawl, Encroachment, NEPP/ESA Coordination
- Actions: Organize Taskforce, Present Briefings

Figure 8. Bob Holst, Bob Lozar, and John Hall discuss some of the ideas.

Longleaf Pine Sustainability (Group 2)

- Research-biology below ground, physics
  - Fire
  - Pine Strow
  - Chemistry Soils
  - Funding, Management. and Research Monitoring
  - Desired Future Condition
- Restoration
  - Site specific tools - hardwoods/aquatic systems
  - Global Change
  - Understanding Issues
  - Single Species Focus vs. Ecosystem
- Information Coordination:
  - Tech Transfer
  - Information Gaps - Use Longleaf Alliance
  - Selling Good Stewardship
  - Conservation Education
- Region of Concern: Information
  - Sharing-Technical workshop
  - Where?
- Issues
  - Fire Relationship
  - Longleaf Alliance
  - Under story?
  - Season of Burn
  - Air Quality
  - Research - root biology
  - Methods of Site Prep.
  - Pine Straw Harvest
  - Restoration and Soil Conditions
  - DoD Installation Support for Fire
- Economic Aspects of LL Management .- Uneven Age Management?
  - Private Lands
  - Use of Forestry Fund on DoD
- Sell Good Stewardship to Landowner

Strategy for Long-term and Broad scale Conservation

Conservation Education

Identify Target Audience

Appropriate Management

Figure 9. Gary, Beverly, and Rebecca absorb the ideas being presented.

Global Environmental Changes

Climate

Disturbance

Invasive

Economic Aspects of LL Management - Uneven Age Management?

Private Lands

Use of Forestry Fund on DoD

Sell Good Stewardship to Land Owner

Strategy for Long Term and Broad scale Conservation

Conservation Education

I.D. Target Audience

Appropriate Management

Global Environmental Change

Invasive

Climate

Disturbance Regions

Sustainability on Low Fertility Soils

Air Quality and Fire Frequency?

What is desired future condition?

Ecosystem Management. Tools

Long Term Sustainability - once restored cam we maintain "museum"

Site Specific Restoration Methods

- Aquatic Systems
- Hardwood Management.

Regional Information Sharing/Coordination.

- Research Workshop
- Management. Workshop

Information Gaps

- Longleaf Alliance?

What is region of concern?

- Fall Line?
- Sandhills?
- Coastal Plain?

What is historical condition?

RCW over emphasized in LL restoration

RCW is 1% funding source for restoration

Single species Management. conflicts

Human values

Funding: ESA vs. ESM

Can a regional network help ESM?

Monitor for success

- Short and long term goals
- Criteria for success
- Rate of change
- Interim Goals

Investigate new techniques for LL Restoration

LL restoration more complexes at edges

Longleaf Pine Sustainability Summary

- Research & restoration needed
- Regional cooperation & information sharing
- Good stewardship and conservation needs to be sold to land owners
- Education needed, identification of audience needed
- Need ecosystem wide management tools and ability to determine desired future condition.
- Redefine allocation of resources from single species management to regional management
- Need to monitor level of success & develop long and short term criteria

Figure 10. Bill Otrosina leads the Loneleaf Pine final wrap-up presentations on Wednesday afternoon.

SEMP – What Next (Group 3)

Questions:

1. Is design transferable?
2. Are indicators transferable?
3. Bring private owners in?
4. Other regions similar but need adaptations?
5. How are we tied to RCW (TES)?
6. Identify visionary partners?
7. Improve Technology Transfer (TT) and sharing?
8. Formalize networking?

9. Tailor briefing and Information better to different audiences?
10. Better do uncut process?
11. More research partners?
    - Involve states?
    - Involves private landholders?
    - Add research off-site?
    - Plan for transmitting Information (on projects)
    - Bridge between research and management?
    - Incorporate successes of others
    - Improve 2-way communication (between agencies)
    - Allow installations managers to set local program priorities
    - Can we incorporate regional issues? (scale up?) (HUCs)

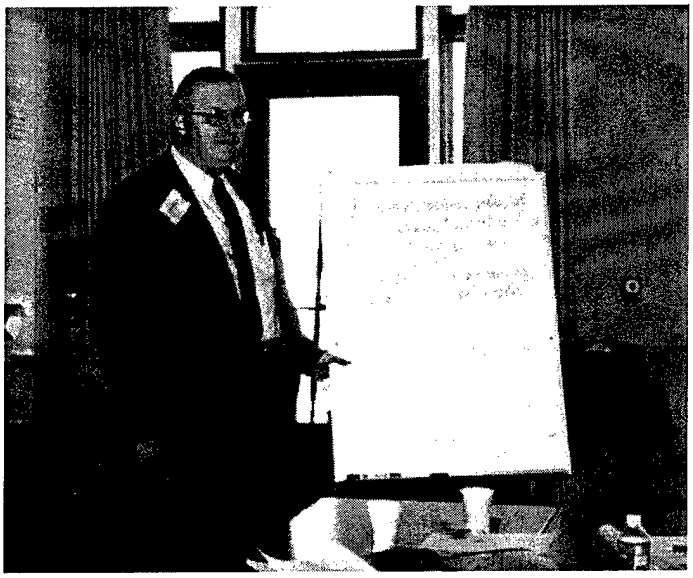


Figure 11. Dr. Balbach Presenting the "SEMP What Next" group findings.

Issues:

1. What of present research is of value to others?
2. Research at other sites of value to SEMP?
3. Avoid duplication of effort
4. Join with other existing groups
5. Does DoD funding restrict potential partnering?
6. Will SEMP results be useful to other agencies with different partners?
7. Are original gaps an issue?
8. Social/Economic aspects ignored?
9. Gaps relate to issues, but don't fully define it
10. Need management priorities to implementing results.
11. Need management, systems analysis

12. Science may serve to justify changes and improvements
13. Develop marketing strategy emphasizing benefits to each
14. Develop own benefits for management changes?
15. Urban "interface research" Wildlife urban interface research

Concerns:

1. Too much emphasis is on LLP/RCW?
2. Lack of appreciation of mosaic of systems?
3. Emphasis not on biology? (at this meeting)
4. Better relate research to specific management goals?
5. Better transfer of research to managers on site?
6. Framework for objectives in the long term
7. Keeping researchers interested in management applications?
8. Should researchers be site-resident?
9. Could a rotating team on site identify research needs?

More parties:

- Private?
- Agencies?
- Sites?
- Stakeholders?
- In planning?
- In Technology Transfer
- In implementation

Installation Management Questions

Pure Research

Applied to specific issues

Which comes first?

More/Better Communication

Networks?

Formal/Informal

Intra-Agency

Inter-Agency

On-Site

Outreach

"Marketing"

SEMP – What Next Summary

- What are the remaining gaps?
- Transferability of research design
    - Value to others
- Can we scale up to regional setting?
- Better Technology Transfer and information sharing
- Partners: Outreach to states, private landowners, improve communication within Federal government.
- Develop marketing strategy which emphasizes benefits
- Need better urban/wildlife lands research interface.
- Need better research/management interface.

Monitoring (Group 4)

Purpose
- Public ownership, stewardship
- Basic inventories
- Tie to management objective
- Target desired future configuration

What to monitor
- To determine eco-condition
- Eco-regional conservation targets on your installation
- To determine effectiveness of management activities

How to - (steps)
- Inventories
- Conservation targets
- Identify future condition and the ecological context
- Measurable management objectives
- Design inventory objectives with desired confidence limits
- Collect data
    - Remote sensing imagery
    - Ground truth

Evaluate monitoring
- Evaluation to see if you reach objectives
- Use models to help managers understand data, futures, and alternatives.
- Use GIS technologies
- Share lessons learned
- Share data and eco- regional context

Next steps
Steering committee
With representatives from different work groups
Web site -- to close on DENIX by CERL

Review work progress - about every six months.

Figure 12. Adrienne Willis, George Carellas, and others during the discussions.

Monitoring Summary

- Purpose: Target desired future condition by developing management objectives of public land stewardship.

- Monitoring eco-condition by objective criteria via conservation management targets

- Activities:
  - Inventories, targets, management prescriptions
  - Data collection and ground truthing
  - Evaluate success in reaching targets with GIS analysis
  - Share experience and techniques with others

- Actions:
  - Organize Steering committee
  - Develop Web site
  - Review progress biannually

6 Workshop Conclusions and Recommendations

In the final afternoon, the reports of all the groups were summarized and a discussion carried on to generate recommendations and resultant actions.

Actions Recommended:

A proceedings would be generated to document the group consensus and recommendations. To be carried out by ERDC/CERL. (This document.)

For the SEMP research effort, carry out an examination of what research efforts on-going at Fort Benning can be applied to other installations, particularly those within the Sandhills Ecoregion. Generate a coordinating proposal to DoD Legacy Resource Management Program to support follow-on work from this workshop.

Establish a Sandhills Ecosystem land managers and monitoring steering committee taskforce, composed of DoD, DOE, EPA, FWS, TNC, and FS representatives. The Steering committee will:

- Define spatial extent of area to be included.
- Define regional goals.
- A communications and information-sharing network would facilitate regional partnerships. To Provide for better communications, an internet web site will be established.
- Implement within the year a Sandhills Monitoring Workshop to continue the sharing of information and review progress.
- Develop a combined interagency formal presentation to be presented by the end of the fiscal year (FY01) to the to the Southeast Natural Leadership Group and to The Longleaf Alliance. These groups could help:

  1. Define the Fall-line ecoregion,
  2. Outline a regional framework, and
  3. Establish regional initiatives such as monitoring initiatives.
  4. The Longleaf Alliance can advise on regional issues in longleaf management and restoration

Peter Swiderek of Fort Benning has agreed to chair The Partnership Committee to address three topics:

- To verify the area that the Fall Line Sandhills Initiative will address
- To develop a purpose statement
- To develop a benefits statement of the Fall Line Initiative.

This information is to be presented to the Southeast Natural Resources Leaders Group in August 2001 in Charleston, SC, with the objective of developing a sense of approval and support from this group. This responsibility however is limited in scope. It is suggested that the next step be the implementation of an executive steering committee to develop various committees such as a research committee, information sharing committee, an outreach committee, etc. This is a start, much work remains to be carried out on an organized, on-going basis.

Figure 13. Rapt attention during the wrap-up session.

Appendix A: Letter of Invitation

You are invited to attend

Partners Along The Fall-Line
Sandhills Ecology and Ecosystem Management Workshop

to be held 6-7 March, 2001

Hosted by: The University of Georgia's Savannah River Ecology Laboratory (SREL), located on the Department of Energy's Savannah River Site near Aiken, SC.

Sponsored by: The Strategic Environmental Research and Development Program (SERDP) Ecosystem Management Project (SEMP).

For additional information on SERDP and SEMP
refer to the following websites:
http://www.serdp.org
http://www.denix.osd.mil/denix/Public/Library/SEMP/semp.html

Focus of the Workshop: to share ecosystem management approaches and technologies between participating land managers and researchers, and to explore the potential for shared ecoregional management and research strategies along the fall line sandhills.

Participants: Representative from DoD, DOE, EPA, FS, FWS, TNC, NCASI, and the research community have been invited to attend. There is no registration fee, however

PARTICIPATION IS BY INVITATION ONLY.

Will you join us?

Please reply to the information below. Thank you!

☐ YES, I definitely will attend. Please send an updated agenda and registration information when available.

☐ YES, I likely will attend and would like to receive an updated agenda and registration information when available.

☐ NO, I cannot attend. Please remove my name from the invitation list.

☐ NO, I cannot attend, but will suggest a colleague: _____

Please provide contact information if you definitely or likely will attend:

Name _____

Representing _____

Email _____

Telephone _____ Fax _____

Address

Other information or suggestions for the workshop:

Further information about SREL, including directions and travel information, can be found at **http://www.uga.edu/srel** or by contacting Juanita Blocker(blocker@srel.edu; phone 803-725-3635) or Beverly Collins (collins@srel.edu; phone 803-725-8158).

Appendix B: Workshop Participants

Aden, Teresa
US Army ERDC/CERL
P O Box 9005
Champaign, IL 61826-9005
Teresa.Aden@erdc.usace.army.mil

Boyd, Kenneth H.
Department of the Army - Fort Gordon
USASC & FG
Directorate of Public Works
Environmental/Natural Resources
Management Ofc
Ft. Gordon, GA 30905-5040
BoydK@gordon.army.mil

Braswell, Allen
Department of the Army - Fort Gordon
USASC & FG
Directorate of Public Works
Environmental/Natural Resources
Management Ofc
Ft. Gordon, GA 30905-5040
BraswelA@gordon.army.mil

Brockway, Dale Gordon
USDA Forest Service
Southern Research Station
520 Devall Dr
Auburn, AL 36849
Dbrockway@fs.fed.us

Camp, Steve N.
Department of the Army - Fort Gordon
USASC & FG
Directorate of Public Works
Environmental/Natural Resources
Management Ofc
Ft. Gordon, GA 30905-5040
CampS@gordon.army.mil

Carellas, George A.
Army's Southern Regional
Environmental Office
101 Marietta St NW, Ste 3120
Atlanta, GA 30303-2720
Carellas@sreo.army.mil

Collada, Angela
The Nature Conservancy
Fort Gordon Project Office
USASC & FG//DPW
Bldg 14600
Ft. Gordon, GA 30905
ACollada@tnc.org

Collins, Beverly
Savannah River Ecology Laboratory
P O Drawer E
Aiken, SC 29802
Collins@srel.edu

Dahlman, Roger
Dept. of Energy, HQ
19901 Germantown Rd
Germantown, MD 20874-1290
Roger.Dahlman@science.doe.gov

Davo, Theresa E.
Fort Benning Army Installation
USAIC, ATZB-PWN-R (Bldg 5884)
Ft. Benning, GA 31905-5112

Dilustro, John
Savannah River Ecology Laboratory
Dept. of Army
USAIS ATSH-OTR, Bldg 2905
Ft. Benning, GA 31905
Dilustro@srel.ed

Drumm, Robert
Department of the Army - Fort Gordon
USASC & FG
Directorate of Public Works
Environmental/Natural Resources
Management Ofc
Ft. Gordon, GA 30905-5040
DrummR@gordon.army.mil

Duncan, Lisa
Savannah River Ecology Laboratory
USAIS ATSH-OTR, Bldg 2905
Ft. Benning, GA 31905
Duncan@srel.edu

Epperson, Deborah
MS Army National Guard/Camp
Shelby Field Office - Clemson
G08 Lehotsky Hall
Dept. of AFW
Clemson University
Clemson, SC 29634
DEppers@clemson.edu

Gawin, Laurie
The Nature Conservancy@Fort
Gordon
USASC & FG
ATZH-DIE
Ft. Gordon, GA 30905
LGawin@tnc.org

Greene, Thomas A.
The Nature Conservancy
P O Box 52452
Athens, GA 30602
TGreene@tnc.org

Holst, Robert
DoD-SERDP
901 N Stuart St
Ste 303
Arlington, VA 22203
Robert.Holst@osd.mil

Koch, Steven
Los Alamos National Laboratory
ESH-20 MS M887
Los Alamos, NM 87544
SKoch@lanl.gov

Kormanik, Paul P.
USDA Forest Service
Institute of Tree Root Biology
320 Greene St
Athens, GA 30602
PKormanik@fs.fed.us

Lohr, Steven
Shaw Air Force Base
20 CES/CEV
345 Cullen St
Shaw AFB, SC 29152
Steven.Lohr@shaw.mil

Maitland, John S.
US Army Fort Jackson
DA, HQ, USATC & Ft. Jackson
ATZJ-DLE-PSF
Ft. Jackson, SC 29207-5400
MaitlandJ@jackson.army.mil

Marston, Tim
Department of the Army
Fort Jackson Wildlife Office
DA, HQ, USATC & Ft. Jackson
ATZJ-DLE-PSW
Ft. Jackson, SC 29207-5400
MarstonT@jackson.army.mil

Morrow, Doug
Fort Jackson Wildlife Office
DA, HQ, USATC & Ft. Jackson
ATZJ-DLE-PSW
Ft. Jackson, SC 29207-5400
MorrowD@jackson.army.mil

Otrosina, William J.
USDA Forest Service
Institute of Tree Root Biology
320 Greene St
Athens, GA 30602
WOtrosina@fs.fed.us

Parris, Steve
US Fish & Wildlife Service
P O Box 52560
Ft. Benning, GA 31995
Steve_Parris@fws.gov

Pendergrass, Levester
US Forest Service
1720 Peachtree Rd NW
Atlanta, GA 30309
LPenderg/r8@fs.fed.us

Robinson, Pam
The Nature Conservancy
P O Box 5475
Columbia, SC 29250
PRobinson@tnc.org

Ryan, Daniel
Shaw Air Force Base
20 CES/CEV - 345 Cullen St
Shaw AFB, SC 29154

Strojan, Carl
Savannah River Ecology Laboratory
P O Drawer E
Aiken, SC 29802
Strojan@srel.edu

Sung, Shi-Jean S.
USDA Forest Service
Institute of Tree Root Biology
320 Greene St
Athens, GA 30602
SSung@fs.fed.us

Sutter, Robert D.
The Nature Conservancy
6114 Fayetteville Rd
Durham, NC 27713
RSutter@tnc.org

Swiderek, Peter K.
Fort Benning GA
P O Box 53354
Ft. Benning, GA 31915
SwiderekP@benning.army.mil

Townson, John R.
Camp Lejeune
Fish & Wildlife Division
Commanding General
AC/S, EMD (FWL)
Marine Corps Base
PSC Box 20004
Camp Lejeune, NC 28542-0004
TownsonJR@lejeune.usmc.mil

Wein, Gary
Savannah River Ecology Laboratory
P O Drawer E
Aiken, SC 29802
Wein@srel.edu

Westbury, Hugh M.
SEMP
USAIS ATSH-OTR, Bldg 2905
Ft. Benning, GA 31905-5593
WestburyH@benning.army.mil

Willard, Steve C.
USASC & FG, Ft. Gordon GA
Directorate of Public Works
ATZH-DIE
Environmental/Natural Resources
Management Ofc
Ft. Gordon, GA 30905-5040
WillardS@gordon.army.mil

Willis, Adrienne
Southern Regional Environmental
Office
101 Marietta St NW, Ste 3120
Atlanta, GA 30303-2720
Awillis@sreo.army.mil

Acronyms and Abbreviations

AFB	Air Force Base
AFI	Air Force Instruction
AFPD	Air Force Policy Directive
AR	Army Regulation
BRAC	Base Realignment and Closure
CERL	Construction Engineering Research Laboratory
CN-N	Ecological Processes Branch
DA	Department of the Army
DENIX	Defense Environmental Network and Information Exchange
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOE	Department of Energy
DOT	Department of Transportation
DUSD (ES)	Deputy Under Secretary of Defense (Environmental Security)
ECMI	Ecosystem Characterization and Monitoring Initiative
EPA	Environmental Protection Agency
ERDC	Engineer Research and Development Center
ESA	Ecological Society of America
ESHEM	Ecoregional Systems Heritage & Encroachment Monitoring
ESOH	Environmental Safety and Occupational Health
FS	Forest Service
FWS	Fish and Wildlife Service
FY	Fiscal Year
GIS	Geographic Information System
HGL	HydroGeoLogic
HUC	Hydrologic Unit Code
ICRMP	Integrated Natural Resource Management Plan
Legacy	Legacy Resource Management Program
LLP	Longleaf Pine
MRLC	Multi-Resolution Land Cover
NALC	North American Land Cover
NASA	National Atmospheric and Space Administration
NERP	National Environmental Research Park
NPS	National Park Service
RCW	Red-cockaded Woodpecker
RS	Remote Sensing
SAA	Southern Appalachian Assessment
SEF	Southeastern Ecological Framework

SEMP	SERDP Ecosystem Management Project
SERDP	Strategic Environmental Research and Development Program
SNRLG	Southeastern Natural Resource Leaders Group
SON	Statement of Need
SREL	Savannah River Ecology Laboratory
SREO	Southern Regional Environmental Office
SRS	Savannah River Site
TAC	Technical Advisory Committee
TES	Threatened and Endangered Species
TNC	The Nature Conservancy
TVA	Tennessee Valley Authority
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFS – SR	U.S. Forest Service – Savannah River
USGS	U.S. Geologic Survey

CERL Distribution

Chief of Engineers
ATTN: CEHEC-IM-LH (2)

SERDP (3)

SERDP TAC (17)

Workshop Participants (36)

Engineer Research and Development Center (Libraries)
ATTN: ERDC, Vicksburg, MS
ATTN: Cold Regions Research, Hanover, NH
ATTN: Topographic Engineering Center, Alexandria, VA

Defense Tech Info Center 22304
ATTN: DTIC-O

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U.S. Army Engineer Research and Development Center (ERDC)
Construction Engineering Research Laboratory (CERL)
P.O. Box 9005
Champaign, IL 61826-9005

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14. ABSTRACT

The Strategic Environmental Research and Development Program (SERDP) Ecosystem Management Project (SEMP) was created (1) to establish one or more sites on DoD facilities for long-term ecosystem monitoring, and (2) to pursue ecosystem research activities relevant to sustaining DoD mission capabilities. The overall program objective is to plan, coordinate, and manage an ecosystem management project initiative that focuses on ecosystem science relevant to DoD ecosystem management concerns. This document contains the proceedings of a workshop (1) to share ecosystem management approaches, information, and technologies between participating land managers; (2) to explore the potential for ecoregional management and research strategies in the Fall Line Sandhills region; and (3) to share and transition the results of SEMP activities at Fort Benning, Georgia, to other land managers across similar ecoregions. Workshop presentations included: ecosystem management challenges; activities at the Savannah River Ecology Laboratory; origin and goals of SEMP; ecoregional systems heritage and encroachment monitoring; a southern Appalachian assessment; cooperative efforts of the Southeastern Natural Resource Leaders Group; regional ecosystem management at Eglin Air Force Base, FL, and the Sonoran Desert; progress in SEMP research; the impact of lightning on longleaf pine ecosystems; and the relationship of coarse woody debris to red-cockaded woodpecker prey.

15. SUBJECT TERMS
Strategic Environmental Research and Development Program (SERDP) SERDP Ecosystem Management Project (SEMP) ecosystem management environmental planning fall line sandhills region land management natural resources management workshop

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